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ABSTRACT

After a brief review of the characteristics of distance education, this paper provides a review of the literature covering the research of the 1980s on teaching, learning, educational planning, organization, and policy formation as it relates to the use of communications technology in contemporary distance education. The main focus is on interactive telecommunications media, i.e., audio, video, and computer teleconferencing. The broad field of education is reviewed, including higher and continuing education and K-12 (children's) education. The issues that are identified and discussed are not those concerned with the effectiveness of communications media per se, but the effects that their use has on certain educational variables, particularly on learners' achievements and attitudes, on teachers' achievements and attitudes, on course design and curriculum issues, on cost, administration, and organization, and policy making in education. Discussions of the implications of the research findings include the need for strategic planning, media selection and usage, the quality of interaction, documentation, and policy research. A 94-item annotated bibliography is provided. (DB)

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THE EFFECTS OF DISTANCE LEARNING: A SUMMARY OF LITERATURE

Michael G. Moore and Melody M. Thompson
with
B. Allan Quigley, G. Christopher Clark, and Gerald G. Goff

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Number 2 in the series **Research Monograph**

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Preface

The Office of Technology Assessment (OTA) is an analytical arm of the United States Congress. Its function is to help legislators to anticipate both the negative and the positive impacts of technological change, and to plan accordingly. In the Fall of 1988 the OTA received a request from the Committee on Labor and Human Resources of the United States Senate to undertake a study examining the opportunities and barriers in using telecommunications and other technologies in education. As a result, in Fall 1989 the OTA published a Special Report called *Linking for Learning: A New Course for Education* that reviewed some of the main events and issues surrounding the application of the newer communications technologies in distance education, particularly the education of children in the public schools. In March 1989 I was approached by the OTA with an invitation to review the distance education literature as it pertained to the focus of the Special Report, and in particular to comment on issues concerning distance education effectiveness. With a deadline of only a few weeks, I welcomed the interest of graduate students Chris Clark, Jerry Goff, and Melody Thompson, and their help in gathering the literature, as well as an offer from Professor Allan Quigley of his service in discussing policy issues.

As publishers of *The American Journal of Distance Education* we are often asked for advice concerning the research on the effectiveness of distance education. Since a result of our work for the OTA was a substantial collection of the literature that addresses the question of effectiveness, we have decided we might provide an additional service to the distance education field by publishing the abstracts of the literature that we used in the OTA report, and our commentary on that literature. This commentary has been edited for this monograph, but is substantially the same as provided to OTA.

I would like to acknowledge the efforts and contributions of the rest of the team who put our report together, especially Melody Thompson who took the lead in the work of abstracting the literature, Allan Quigley who contributed his expert knowledge of educational policy research, Chris Clark for his insights into K-12 education and Jerry Goff's general involvement. I would also like to thank Janet Hartranft for typing, formatting, and producing the monograph.

I am also grateful to The Office of Technological Assessment for permitting this additional use of our work, and especially to Linda Roberts the Project Director on "Linking for Learning" for

her advice and encouragement. However I wish to emphasis that no endorsement of this monograph was sought from the OTA nor has been given, or is implied. Where opinions are expressed they are my own, and should any cause offense, while no offense has been intended, I will accept responsibility, as I will also accept responsibility for errors and omissions. I would be glad for correction where such errors are found. I would also invite readers who have other information about the effectiveness of distance education to send it to me as an article for *The American Journal of Distance Education* or by the more informal medium of the Distance Education Research Symposium that meets on CompuServe. Information about writing for or subscribing to the Journal or about DEOS can be obtained from the offices of The American Center for Study of Distance Education. Readers' inquiries and participation in our activities are warmly welcomed.

Michael Grahame Moore

Introduction

Meaning and perspective of distance education

The term "distance education" has been borrowed from the European terms, Fernunterricht, Télé-enseignement, and Educación a Distancia to describe all teaching-learning arrangements in which the learner and teacher are normally geographically separated, and to focus on the special nature of course design, learning and instruction under such circumstances (Keegan 1986; Holmberg 1986).

The most notable characteristic of all distance education is that communication between learners and teachers is through print and writing or by electronic media such as broadcasts, recordings, narrowcasts by cable, satellite, ITFS, and fiber transmission, interactive telecommunication by computer, audio and video teleconferences or, as is increasingly common, combinations of these media.

A second significant characteristic of distance education arises from the first. It consists of a new approach to instruction, with the process of teaching being broken into its constituent parts. Some or all of these are prepared away from the learner, and communicated to the learner through the communications technology, with the possibility of interaction between the learner and an instructor also being through communications technology. In distance education, courses are usually designed for distribution to audiences that are larger, and over geographic areas that are wider than conventional education. Although course materials are produced more centrally, local instructors help learners make individual sense of, and develop critical responses to them. Because the work of many specialists is involved in course design and learner support, systems design principles are followed to integrate their work, to ensure the course is produced on schedule, and to ensure that instruction will have the maximum effect on a population that is both large and also very diverse. Because costly media and expensive specialists are employed, and because they require considerable time to produce, the total cost of distance courses is much higher than conventional teaching. As a result of this investment they are likely to be of high quality compared to the work of individual teachers. To obtain economies, the cost can be amortized over a large student body so that the restructuring of resources results in LOWER per student costs even for higher quality instruction.

It is for these three reasons, summarized below, that questions of effectiveness have to be asked and answered, research and new training proposed:

1. Distance education uses technologies that are unfamiliar as the primary media of communication for teaching to most teachers and administrators.
2. Distance education requires teachers to specialize in the various functions of teaching, especially those of: counsellor, content expert, facilitator of interaction, course designer, and learner. Such distinctions are unfamiliar to most teachers and administrators.
3. Distance education requires planning, development, production and distribution on a larger scale than is familiar to most teachers and administrators, and requires major intervention by policy makers at national and state levels.

Purpose and outline of the paper

In this paper, after a brief review of the general characteristics of distance education, a review of literature will report the research of the 1980s on the main issues in teaching, learning, educational planning, organization and policy making with regard to use of communications technology in contemporary distance education. The main focus will be on interactive telecommunications media, i.e., audio, video, and computer teleconferencing. The broad field of education will be reviewed, including higher and continuing education, and K-12 (children's) education. The issues that will be identified and discussed are not those concerning the effectiveness of communications media per se, but the effects that their use have on certain educational variables, particularly on learners' achievements and attitudes, on teachers' achievements and attitudes, on course design and curriculum issues, on cost, administration and organization, and policy making in education.

History and international scope: A thumbnail sketch

The origins of contemporary distance education are to be found in correspondence education, a method invented in the late 19th century to provide instruction to learners unable to attend a class, and subsequently adapted for use by classes who did not have access to teachers of particular subjects. Correspondence instruction remains an important method of

distance education, though it is usually supplemented and is frequently replaced by electronic media. As early as 1938, educators concerned with the distant learner formed the International Council for Correspondence Education (ICCE). In recognition of the ascendancy of electronic media, the ICCE changed its name in 1982 to International Council for Distance Education (ICDE). At its most recent World Conference—in Oslo in 1988—there were some 600 delegates from over fifty countries, including more than fifty Americans.

In attempting to classify the many thousands of distance education organizations worldwide, Neil (1981) distinguished between the "whole system control model" such as the British Open University and institutions that are "embedded into communities of educational agencies" (p. 130). These embedded institutions have to share authority with a parent organization in four areas of management where the "whole system" has autonomy. They are: finance; examinations and accreditation; curriculum and materials; and delivery and student support services. Until the present time the United States has not developed a whole system control model like the open universities, but has many examples of "embedded" institutions, including the extension divisions of the universities. This is also the preeminent organizational form in socialist countries. Nearly half the students in higher education in China, more than a million students, are distant learners. In the Soviet Union 30 percent of all students in higher education, i.e., some 1.5 million students, are in distance education, and in East Germany a quarter of the 1.7 million university and technical college graduates have attained their qualifications by distance education.

In the United States, at the adult level, distance education has been embedded for many years in the corporate, military and university continuing education sectors. The communication media traditionally used have been print, recording or broadcasting. In recent years these have been joined by various new forms of telecommunications, and in these technologies the United States leads most of the world. At the university level for example, membership of the National University Teleconference Network has grown to more than 260 organizations either providing or receiving a range of over one hundred programs by satellite. In the National Technological University, twenty-four of the country's major universities collaborate to produce about five hundred post-graduate courses in engineering delivered by satellite directly to more than one hundred work places. More than 40 percent of Fortune 500 companies use video conferencing. The American Telephone and

Telegraph Corporation for example expanded from five videoteleconference sites in 1983 to 130 in 1987. As well as corporation owned systems there are also a number of generic delivery systems. In 1982 there were two such "business videoconference" networks; by 1987 there were over forty. Examples are The American Rehabilitation Educational Network, providing professional continuing education for health care professionals at nearly one hundred sites nationwide. Public bodies that use telecommunications satellites in their continuing education programs, organized by The Public Service Satellite Consortium include The American Hospital Association, The American Law Institute, American Bar Association Committee on Continuing Professional Education, The National Education Association, The AFL-CIO, and the U.S. Chamber of Commerce.

Course design

Designing distance learning materials means organizing and controlling the work of many specialists including subject authors, instructional technologists, illustrators, television, recording and other media specialists, librarians, photo-librarians, and editors. Teams used in many Open Universities may be as large as twenty people, and have budgets of several million dollars for one course. The purpose of their work is to structure academic content in a form suitable for study by distant learners. Devices to ensure feedback must be constructed (Howard 1987) as well as to provide for the different pace at which students learn (Shale 1987). Instruments for the evaluation of learning must be designed. Multiple copies of course materials must be produced and distributed either as printed packages, or by electronic means.

An alternative to the course team is the "author-editor" approach in which a sole academic is contracted to write course content for editing into a teaching program by professional editors. While this approach has been traditional in correspondence education, an analogue is seen in teaching by electronic media, when content is contributed by an expert, and produced by telecommunications specialists. A major weakness of such author-editor arrangements is that neither expert is usually an instructional designer.

When considering course design, some of the new media are of special significance, since they are more powerful for communicating several of the processes of instruction than were older media. For example electronic mail and computer conferencing offer new opportunities for

student involvement and participation in instruction. However the excitement of using new varieties of electronic media sometimes distracts educators and others from making the most suitable selections of media. Wagner and Reddy (1987) warn against educational decision making that is "hardware driven" and insist that electronic media must "be selected according to instructional needs, professional and technical expertise, and according to one's available budget" (p. 49). "The greatest problem" Bates (1984) writes, "is deciding which media to use, and the different ways in which each medium should be used so that they complement one another...It is a great pity that as much energy and investment is not put into this as there is in media production and distribution" (p. 227).

Student Support

The literature suggests that a requirement for successful distance education may be a carefully designed and maintained learner support system. In such a system, teachers, highly qualified and experienced in the understanding of learners and learning, but not necessarily in the academic subject, support students by: providing skilled diagnostic counselling and orientation programs; assisting students to organize their time and develop their study skills; providing active tutorial assistance during the course, face-to-face if needed and feasible; monitoring written work not only for cognitive achievement but for affective responses; ensuring that instructors involve students in the instruction of the course; and giving assistance when illness, financial, family or work difficulties threaten to overpower the motivation to study (Rumble and Harry 1982; Feasley 1983).

Literature Review

Examples of distance education in the schools

The University of Nebraska-Lincoln Independent Study High School (ISHS) is a fully accredited high school which in the 1988 school year recorded 12,412 high school course correspondence registrations. The school employs twenty-eight full- and part-time teachers and has issued nearly one thousand diplomas in the past sixteen years (ISHS 1988). Alaska and North Dakota have complete secondary correspondence schools (Valore and Diehl 1987). Barker and Logan (1985) note that a high school in Washington expanded its course offerings from fifteen to one hundred through the addition of supervised correspondence study.

Audio teleconferencing is especially popular as a means of bringing distant experts into the classroom. Examples have been found in New York where students talked to a rock musician in California (Galvin 1987), and in North Carolina where students in the School of Science and Mathematics talked with historians and diplomats (Wilson, Little, and Wilson 1986). Nebraska's ISHS sponsors a TeleLanguage program which combines independent study and regular conference calls to teach modern languages to students in twenty-four school districts (Wall 1985). High school math and science instruction is offered in Louisiana (Pinsel 1988), and in Tucson, Arizona the Homebound/Teleteaching Program has allowed seriously ill or handicapped students to participate in classes through telephone hookups (Hudson and Boyd 1984).

Computer conferencing was recently used by second graders in Illinois to "talk" with a children's book author (Handler 1988). Students in Hawaii have combined audio and computer-based messaging to bring in guest speakers and communicate with other students in Massachusetts, Japan, and other locations (Southworth and Klemm 1985). AT&T is piloting a "Long Distance Learning Network" in over three hundred classrooms in six different countries (AT&T 1987).

Audiographics and a teleconferencing bridge have been used since 1985 in New York to connect as many as five rural schools at a time to deliver advanced high school courses (Benson and Hirschen 1987; Galvin 1987). Garfield County, Utah's Tele-Learning Network and the Pennsylvania Teleteaching Project also use audiographics in schools (Barker 1987a).

A variety of technologies can be used to connect schools. Twenty-eight school districts in Virginia were linked through a combination of ITFS and open broadcast, and fourteen ITFS centers in South Carolina

served 380 schools (Pinsel 1988). Two large systems in Richardson and Houston, Texas serve a total of eighty schools (Barker 1987a); Houston's InterAct network alone covers seven counties (Hudson and Boyd 1984). The Chico campus of the University of California originates interactive video programs delivered to schools by fiber optics. Microwave technology has linked three small rural schools in Iowa and two in Michigan in separate interactive television programs. Siegmund and McFadden (1985) describe the Carroll (IL) Instructional Television Consortium, a cable-based system, which joined four districts to offer six courses in 1984-85.

Pinsel (1988) writes that in 1986 six hundred school buildings in the United States owned satellite receiving equipment. Among the large scale satellite efforts is the TI-IN service, which broadcasts courses to high schools around the country from Texas. TI-IN sends nearly two dozen courses over the air waves five days a week (Clark 1988). The Arts and Sciences Teleconferencing Service, based at Oklahoma State University, began offering high school German in 1985 and has since added Calculus, Physics, History and Government (Bond 1987; Clark 1988; Arts and Science Teleconferencing Service 1988). Other satellite programs for schools include Kentucky Educational Television (KET), which recently received funding to provide downlinks at all schools; the LearnAlaska network which served 250 communities in that state (Bond 1987); a system in Utah that delivers Spanish to more than two dozen schools (Pinsel 1988); and The Satellite Telecommunications Educational Programming Network in Spokane, Washington (Clark 1988).

Television programs broadcast by the Public Broadcast System have been used in schools for many years, and the commercial networks are beginning to offer more programs, such as the mini-series "Roots," complete with teacher support materials. As allowed by law, regional agencies and local schools often tape programs for delayed classroom use. Pinsel (1988) discusses other technologies being used by schools in the United States.

Learner achievement

K-12. Literature on distance education in general and the effective use of interactive technologies in particular in schools (K-12) is scarce, and that which is available consists mainly of case studies, opinions, and advice. Eiserman and Williams (1987) found that of 503 documents pertaining to the general topic of distance education, most dealt with its application to higher education, specifically program descriptions and

problems encountered in higher education settings. As they point out, "while it is possible that some of what is being learned about the various components of distance education is relevant to its use in public schools (K-12), there is no evidence of any empirically founded comparisons."

Of the 503 documents they identified, only forty-six specifically related use of distance education and technologies to schools: twenty-two were position papers, seven described instructional materials, three pertained to technical components, five were reviews of research, and nine were primary research studies. Even these last fourteen articles provided little or no empirical evidence to support claims of general effectiveness. Additionally, although all reports claimed positive results, they defined effectiveness in a variety of ways, which included:

- The extent to which programs are made available to students who otherwise would be deprived;
- How cost effective the program is;
- How diverse the students educational experience is;
- Cognitive and/or skill gains;
- The degree to which teacher loads are eased.

Additionally, Eiserman and Williams found no studies comparing effectiveness of instruction across types of populations (general K-12; exceptional students), no effectiveness data comparing different content areas, and none comparing the effectiveness of instruction using different instructional designs.

Batey and Cowell (1986), in their overview of distance education, suggest that, while there has been little systematic evaluation of the educational effectiveness of distance education at the K-12 level, that which has been conducted (both K-12 and postsecondary) indicates that students learn as well in distance education programs as they do in regular programs and that student attitudes toward such programs are generally positive. They also believe effectiveness is reflected in often unanticipated side effects of distance programming such as: higher levels of communication cooperation between schools and districts, parental involvement with courses, and exposure to or mastery of a new technology which students and teachers can apply to other areas.

A nationwide telephone survey sponsored by the Utah State Office of Education sought to provide information on the effectiveness of technology-based elementary and secondary educational projects

(Quinn and Williams 1987); the findings reflect the lack of systematic evaluation reported by others. Thirty-eight percent of the schools surveyed reported no evaluations for the programs they described; 51 percent stated that they performed evaluations, but only 20 percent provided evidence. Aspects of effectiveness reported include enhanced equity between small rural schools and their larger counterparts, expanded curricula through the use of additional learning experiences and exposure to famous personalities, and high levels of acceptance by students, parents, and teachers.

Teachers and administrators in Iowa's two-way interactive television (TWIT) project found no significant differences between TWIT classes and other sections of the same class taught face-to-face by the same teacher (Nelson 1985). Daily lesson scores, test scores, quarter and semester grades, and levels of participation were comparable for the two groups.

The Carroll Instructional Television Consortium, formed to increase the total number of course offerings, promote achievement as measured by content mastery of advanced level course work, and increase the efficiency of teacher instructional time in four rural Illinois high schools, has been in operation since 1983. Robinson (1985), in his study of the program, reports that the project was effective in terms of expanded curricula and higher levels of teacher efficiency. Teacher effectiveness was perceived to be above average, and students in remote interactive television classes achieved as well on post-tests as did students in traditional classrooms.

In testimony to the Senate Committee of Labor and Human Services, Kitchen (1987) reported on the effectiveness of interactive television (ITV) in rural school districts in Minnesota. He states that, in a wide range of elective programming provided from 1983 to 1986, no statistically significant differences in achievement were found between students taking courses traditionally and by ITV.

Barker (1987a) reports on a survey to determine perceptions of thirty high school principals of effectiveness of the TI-IN satellite network, which broadcasts courses from Texas to high schools around the country. Student-teacher interaction was rated "very good" or "excellent" by 77 percent of the respondents; quality of instruction was rated as "very good" or "excellent" by 74 percent of the respondents. Barker did not elaborate on the criteria used to measure these factors.

Braucher (1983), in an interesting anecdotal report, comments on the effectiveness of audioteleconferencing classes for homebound junior and senior high school students noting the surprisingly high levels of

interaction possible with this medium. She suggests the following factors contribute to this level of interaction:

- Familiar surroundings which lead to feelings of comfort and security;
- Absence of distractions;
- Privacy (and invisibility), which precludes much embarassment and accompanying stress;
- Smaller classes and, therefore, familiar classmates.

Braucher contends that teleteaching is highly interactive and, since "it is interaction itself which instructs," highly effective (Braucher 1983, 64). She, too, would like to see empirical evidence to support her anecdotal evidence. She comments:

> Almost every activity in teleclasses has an exact match in conventional classrooms. Yet the results seem to be better in our teleclasses than in the classroom.
>
> There are a number of possible explanations for the greater effectiveness of teleclass interaction. None of them has been officially researched, however. We offer them only as intuitions and hope that a study in the near future will verify what we now can only suspect (p. 67).

As Eiserman and Williams (1987) suggest, although much of the literature is vague and overly general, several important conclusions with implications for effectiveness can be drawn from what is currently being written:

- Although current programs are at various stages of implementation, most are still in the initial stages of planning.
- Those programs which have gone beyond the initial stages have been accepted by state accreditation agencies and have resulted in expanded curricular offerings.
- Distance education programs are effective in providing educational service to those who would otherwise be unserved.
- To maximize benefits from new technologies, developers are finding new applications (such as teacher training) for distance education technologies.

Adults. A number of studies, especially early ones, compare the effectiveness of teleconferencing with face-to-face instruction. These studies were conducted with various adult populations (non-credit students,

undergraduate students, graduate students, medical personnel, military personnel, elementary school teachers, laboratory subjects, etc.) and in a variety of content areas (finance, library science, psychology, mathematics, etc.) and all conclude that delivery of educational programming via teleconferencing is educationally effective.

To determine the effectiveness of audioteleconferencing as a means of delivering educational information, Blackwood and Trent (1968) performed a study of adults participating in a cooperative extension class ("Money Management"). They report that there was no difference in the amount learned by telelecture and by face-to-face teaching, and that there were no associations between the amount of learning which occurred via each method and the variables of age, level of education, time of day, and attitude.

Boswell, Mocker, and Hamlin (1968) compared the result of remote teaching and face-to-face instruction in three classes of Introductory Psychology. Pre- and post-test results showed no significant differences in mastery of content; student course evaluations showed no difference in student attitudes.

To examine differences in student achievement and attitudes in college classes taught by traditional instruction and by audio teleconferencing and Electrowriter, Puzzuoli (1970) conducted a study of university extension classes. He concluded from a comparative analysis of achievement of the two groups that the remote classes performed as well or significantly better than the resident students, and that student attitudes varied depending on the telelecture model used.

Hoyt and Frye (1972) compared the educational effectiveness of six undergraduate and graduate level courses taught by audio teleconference with that of identical on-campus classes. Evaluation included instructor assessment of achievement (post-test scores on achievement tests, final exam grades, final course grades) and student evaluation of the extent to which personal goals were met. The authors concluded that instruction via audio conferencing was as effective as that delivered traditionally.

Chapanis (1976) focused on human factors in telecommunications and the influence of these factors on effective learning. He discusses 1) how people naturally communicate to solve problems of various types, 2) how interactive communication is affected by technological devices and systems, and 3) what system and human variables affect interactive communication. He concludes that some communication tasks common in educational settings, such as exchanging information or opinions, solving problems, and generating ideas, are as effectively carried out in electronically mediated situations as in face-to-face situations.

Christopher (1982) discusses a system for providing instruction to Air Force students at remote sites in eight states via the Tele-teach Expanded Delivery System (TEDS). He concludes, on the basis of statistical analysis of test scores, that students learned at least as well as resident students and that student attitudes were positive, especially for shorter courses.

In another study of educational technology in the military, Partin and Atkins (1984) measured the effectiveness of an audioteleconferencing system supplemented by an electronic blackboard for the delivery of educational programs to Department of Defense managers. Data collected were used to compare the achievement and attitudes of students in teleteach and traditional classes. The authors report that for one of the two courses examined, the percentage of A's and B's was considerably less in the teleteach classes (40 percent and 54 percent) than in the resident classes (73 percent); for the other course, the percentage of A's and B's in the teleteach class (88 percent) was comparable to that in the resident classes (83 percent).

Kruh (1983) reports on results of a study of six university courses taught by teleconferencing compared to courses taught in the traditional manner. She provides sample evaluation forms, describes the treatment of data from student evaluations, and concludes that academic achievement and student satisfaction in teleconferencing classes is equal to that of students in resident classes.

A project to increase the availability of continuing education to nurses and to develop and evaluate alternative educational delivery methods is described by Kuramoto (1984). Evaluation was conducted on the basis of learners' academic performance and learners' attitudes and behaviors. Eight variables, including cognitive pre- and post-test scores, attitude scores, intent to use and actual use of course content, attendance, and attrition were analyzed to assess effectiveness. She concludes that all three delivery methods evaluated (face-to-face, teleconferencing, and correspondence study) were effective in terms of increasing cognitive knowledge and that findings related to attitude were mixed and inconclusive.

To determine the validity of the belief that classroom instruction is inherently superior to alternative delivery systems, such as teleconferencing, Weingand (1984) analyzed differences in the performance of students in a graduate level library science course taught both by teleconferencing and in the traditional classroom setting. He concludes that 1) there is no evidence to support the idea that face-to-face instruction is the optimum delivery method, 2) instruction by teleconferencing can facilitate learning as well as or better than can classroom instruction, and

3) the absence of face-to-face contact is not detrimental to the learning process.

Chute, Bruning, and Hulick (1984) compared multi-modes of delivery and student achievement outcomes. Two groups, one taught traditionally and one via teleconferencing (electronic conference board, two-way voice, and graphics), were presented with identical content and hours of instruction. Although the pre-test scores of the two groups were not significantly different, the post-test scores of the teletrained group were significantly higher than those of the traditional classroom group. The authors conclude that the teletrained group learned as well, if not better, than the face-to-face group.

Vandehaar (1986) examined the concept of educational effectiveness from a broader perspective than that of other writers. Believing that measures of effectiveness should include dimensions other than cognitive development, she investigated the extent to which the basic configuration and procedures of teleconferencing classrooms encourage or limit the seven vectors of student development described by Arthur Chickering, a student development scholar. She concludes that, although student cognitive development is comparable to that in traditional classes, "current use of the teleconference classroom basically accomplishes data movement, not quality learning as described by Chickering" (Vandehaar 1986, 342). Although teleconferencing, as currently implemented does not serve to foster multiple dimensions of student development, Vandehaar believes that none of the barriers to development is the direct result of the teleconferencing format, but rather results from limited or inappropriate teaching behaviors and implementation on the part of instructors. Such a conclusion has important implications for the proper training of instructors in the teleconference classroom.

Learner perceptions and attitudes

Researchers and reviewers have looked at the subject of learner attitudes from several perspectives. Some are concerned with merely assessing (qualitatively or quantitatively) the level of learner satisfaction with distance education courses; others attempt to discover the extent to which students perceive communications technologies to affect the teaching/learning transaction; some address the concept of student perception of effective teaching behaviors; a few discuss ways of changing user attitudes.

K-12. Several of the authors mentioned earlier provide general reports of positive student attitudes to telecommunications (Batey and Cowell 1986; Quinn and Williams 1987). Two authors who attempt to quantify student perceptions report mixed results.

Nelson (1985) reports that when students instructed via the Iowa TWIT system were surveyed regarding their perceptions of the programming, 97 percent indicated no more problems in the televised classes than in traditional classes; 67 percent believed they accepted more responsibility for their behavior and learning in TWIT classes; 97 percent indicated a willingness to enroll in another televised class; and 94 percent believed their level of achievement was as high or higher in televised classes.

Barker (1987b), in his survey of TI-IN students, found that 24 percent of the students perceived satellite courses to have the same level of difficulty as their regular class; 65 percent believed them to be more difficult. Almost 70 percent of the students indicated that they would choose a traditionally instructed course over a satellite course. The main weaknesses reported by students included the amount of work, difficulty in hearing, difficulty contacting the teacher, and inadequate teacher preparation and training. Strengths reported included the availability of increased course offerings and varied and interesting instruction. Students recommended that the quality of the audio be improved, that larger monitors be installed, and that the reception equipment be kept in good repair.

Adults. Many of the studies discussed in the section on effectiveness indicate that general adult student attitudes toward telecommunications are positive (Boswell, Mocker, and Hamlin 1968; Hoyt and Frye 1972; Christopher 1982; Kruh 1983). More specific aspects of student attitudes are addressed by Smeltzer (1986), who investigated the effects of electronic communication on the variables of student stimulation, reinforcement, and participation. He reports on a study to determine students' perception of the extent to which the quality of the teaching/learning transaction is affected by the teleteaching format and presents qualitative and quantitative evidence that audioteleconferencing does not preclude communications-rich interactions between participants. Davis (1984), however, in a study comparing instruction via teleconferencing, face-to-face teaching, or a combination of the two methods, found that face-to-face delivery results in more positive attitudes; as face-to-face contact increases, so does learner satisfaction with the method of instruction. There was no significant relationship, however, between attitude and achievement.

Partin and Atkins (1984) report that Department of Defense managers in teleteach courses are generally receptive to technological delivery. Based on student responses to an evaluation questionnaire, the authors conclude that students perceive distance delivery to provide an effective learning experience unhindered by the physical absence of an instructor. Students indicated that the presence of a facilitator at each site and the proper functioning of equipment were important.

In investigating student perception of teaching behaviors necessary for effectively delivering courses both conventionally and via teleconferencing, Haaland and Newby (1984) observed five statistically significant differences in the frequency of effective teaching behaviors of those teaching by teleconference. Effective teleconference teachers: 1) used students' names, 2) set out clear statements of purpose, 3) made use of printed material, 4) encouraged discussion, and 5) did not speak in a monotone. The authors conclude that the delivery mode has no effect on students' overall rating of the courses or on ratings of instructors' ability.

Shaeffer and Roel (1985), in a study to empirically determine which teaching behaviors students consider necessary in teleconferencing and in face-to-face courses found differences in students' perceptions of the two delivery modes, however. Using group interviews and questionnaires to obtain student feedback, they discovered that on the basis of perceptions of instructor clarity, enthusiasm, organization, pacing, and encouragement of student participation, students in teleconferencing courses gave higher ratings of the course and the instructor's teaching ability than did those in the face-to-face course. They suggest that these differences perhaps result from the instructor's attempt to alter behavior because of a knowledge of appropriate teleteaching techniques, techniques which, if used, may heighten student satisfaction with face-to-face instruction, as well.

Pryor (1985) addresses the variable of student attitudes from the perspective of understanding and changing attitudes, and thus behaviors. He discusses the problem of user resistance to teleconferencing in terms of resistance to change, and the idea that participant attitudes directly affect behaviors in a teleconferencing situation. He presents a model for understanding and evaluating attitudes and behaviors, and a model for changing negative attitudes and behaviors toward teleconferencing. Bevan (1983) also examines the concept of changing user attitudes. Viewing user reaction in terms of uncertainty, stress, and the need to change, he concludes that training and technical help for participants should be based on proven techniques from the psychological and

sociological disciplines, and presents strategies for assisting users in making attitudinal and behavioral changes necessary to perceive teleconferencing as a non-threatening communication tool.

Instructor skills

Many instructor behaviors which contribute to effective teaching are visual behaviors: eye contact, gestures, facial expressions, etc. Distance education instructors in many media must replace such behaviors with alternative actions; they must also develop a repertoire of behaviors unique to the distance teaching experience in order to enhance the overall teaching/learning transaction. The literature reflects general agreement that most of these skills are necessary and appropriate for teachers at any level of instruction.

Bronstein, Gill, and Koneman (1982) contend that those teaching via teleconferencing must make adjustments in their delivery style in order to enhance their instruction. They provide the following guidelines for instructional delivery:

- Be prompt in coming on the line. The program must start on time.
- Use a natural style of delivery; speak slowly and enunciate clearly.
- Maintain spontaneity; avoid reading from a script.
- Use visuals effectively and verbalize appropriate guideposts.
- Use frequent change of pace or stimuli to maintain interest.
- Make frequent attempts to draw participants into discussions.
- Always refer to participants by name.
- Give short concluding summary of concepts presented.

A number of other authors list similar skills needed by successful teleconferencing teachers (Monson 1980; Pereyra 1982; Boone and Bassett 1983; Parker 1984).

As Boone and Bassett (1983) point out, identification of these specific skills appropriate to distance teaching has been based primarily on personal opinions rather than on systematic evaluations. Yet, as noted above, similar or identical skills are listed as important to the success of teleconferencing by many different authors. To discover the extent to which this "common wisdom" regarding necessary skills is well-founded, Boone and Bassett conducted a study in which "expert opinion" was used to verify the appropriateness of skills identified by an extensive

examination of the literature. In looking at the categories of facilitator skills (before, during, and after a meeting or class) and participant skills, they found a high correlation between skills identified as important in the literature and those identified by teleconferencing experts. Additionally, they identified which skills, based on empirical evidence, could effectively be taught. Specific oral communication skills identified include: 1) pronunciation and articulation, 2) fluency, 3) rate of speech, 4) inflection, 5) volume of speech, 6) pausing, 7) positive feedback statements, 8) conversational questions, 9) compliments and appreciation statements, 10) anecdotes, 11) latency of response time, and 12) duration of oral statements.

In a follow-up study, Boone (1984) attempted to operationalize some of the more "ambiguous" teleconferencing skills mentioned in the literature. Analysis of tapes of actual audioconferences provided specific examples of such skills, which include the abilities to:

- Provide structure (uses authority; controls verbal traffic);
- Provide socio-emotional support (integrates late group member; encourages humor);
- Establish a democratic atmosphere (shares authority; asks for participation);
- Create a sense of shared space (describes environment; creates a sense of shared history, when possible);
- Model appropriate behavior (models conciseness);
- Clarify (asks for confirmation; seeks common definition of terms);
- Repair sessions threatening to go awry (explains absence of group member; repairs interruptions);
- Set an appropriate pace (asks for conciseness; directs questions to a limited audience).

She concludes that any teleconferencing experience is only as effective as its facilitator; for this reason major emphasis should be placed on the appropriate training of instructors who teach via teleconferencing.

Braucher (1983) stresses the extent to which effective teaching behaviors are the same for teleteachers and for classroom teachers. She suggests that developing a friendly atmosphere, accurately transmitting feelings by tone of voice, carefully selecting words, appropriately using silences, showing respect for fragile adolescent egos, and thoughtfully integrating new students are skills which distinguish effective teachers in any setting or delivery situation.

Program design considerations

The unique characteristics of the distance education experience often require either unique design elements or original methods for implementation of more traditional elements.

Batey and Cowell (1986) contend that differences between distance education and traditional education demand new program management skills. They list a variety of management considerations likely to require new approaches:

- Establishing lines of responsibility;
- Obtaining and handling funds;
- Planning;
- Record keeping and reporting;
- Supervising students;
- Obtaining, managing, and repairing equipment;
- Scheduling classes;
- Scheduling existing staff;
- Recruiting new staff;
- Managing program change and updating program content;
- Managing contracts and financial agreements;
- Cooperating with other educators;
- Dealing with new entities in the community and occasionally with new clientele (p. 21-22).

Additionally, these authors suggest that distance education design and management considerations at the building, district, and higher levels are in many ways more similar to those of business and industry than to those of traditional education programs. New issues of this type which will need to be addressed include FCC and government regulations, state approval for new curricular changes, certification and accreditation implications for instructors, cooperation with other districts, and community public relations campaigns.

Finally, Batey and Cowell (1986) emphasize the importance of incorporating evaluation strategies into any distance education project. They contend that an evaluator should be included on the program development team and should participate in both the design and implementation of projects. The following suggestions for formative and summative evaluations are offered in their publication:

Formative Evaluation

- Conducting a thorough needs assessment
- Studying the context in which the project will operate

- Analyzing policy and procedural alternatives
- Monitoring all major activities and processes of both development and implementation
- Determining the success of major components, programs, and systems
- Providing continuous input to the design team
- Identifying problem areas

Summative Evaluation

- Determining the success of major components, programs, and systems
- Determining the success of the project as a whole measuring student completion rates, achievement gains, and satisfaction
- Measuring reactions and opinions of teachers, administrators, and the community in which the project is taking place
- Measuring side effects and unanticipated outcomes
- Determining desirable modifications for the next development cycle of the project or for the next project
- Suggesting appropriate next steps (p. 27-28)

Norenberg and Lundblad (1987), in their general review of distance education in secondary, post-secondary, and adult education, contend that distance delivery of educational programming places unique conditions on the learning environment, conditions which must be addressed in the initial stages of program design. Since each technology alters the role of instructors, affects learners, and influences the appropriateness of instructional design in a different manner, media selection is an issue of major importance. They suggest that media selection in a given situation depends on a number of factors, including the objectives of the organization, initial cost, personnel, anticipated use, level of interactivity desired, technological infrastructure already in place, legal considerations, topographical context, equipment compatibility, users, governmental and school jurisdictions, business service areas, and cost of operation.

In order to assist in important initial design decisions, Norenberg and Lundblad (1987) have developed two planning matrices addressing a variety of design considerations. Matrix 1 presents general, learner, teacher, and pedagogical considerations for each medium or technology; Matrix 2 presents technology costs, advantages, and limitations. These matrices, by illustrating the differences between the technologies and

their applications to different educational settings, can aid distance education planners in their educational and management decisions.

The North Carolina Office of Day Care Services, in a comprehensive study of the feasibility of using telecommunications to train child day care workers, examined a number of design considerations, including budgeting, selection of media, and evaluation (North Carolina State Department of Human Resources 1985). They tested four alternative training approaches: audio, audio/video, slow-scan, and traditional (face-to-face). Results indicate that significant gains in knowledge were made by students in all of the training situations, that students were extremely enthusiastic about all four methods of training, and that, in this situation, only audio training was cost-effective. The authors conclude that a realistic plan for the implementation of teleconferencing instruction depends upon the following design considerations: location of the teleconference centers; selection of appropriate telecommunications technology; development of content appropriate to the media; frequency of content delivery; length of teaching sessions; multiple vs. single transmissions; and expanded applications for telecommunications technology.

Dutton and Lievrouw caution that, since media differ in their suitability for different educational tasks, media selection must be "content-driven" rather than "technology-driven," that consideration of instructional content, the need for involvement, and particular learning outcomes desired should provide the primary basis for technology choices (Dutton and Lievrouw 1982, 113). They discuss many old and new educational media and compare them on the basis of kind of communication supported (one-way, reactive, two-way), ease of modification, expense, complexity, and learning taxonomies (cognitive, affective, psychomotor).

Wagner and Reddy (1987) echo this caution against "hardware driven" design decisions, which are often based on the assumption that teleconferencing is suitable for the delivery of all educational programming or that one particular technology is suitable for all situations. They present a conceptual foundation for instructional programming based on a four-stage process on "a continuum of abstract-to-concrete, theoretical-to-applied, process-to-product activities" (Wagner and Reddy 1987, 50). Implementation of this process, they contend, will encourage design decisions made from a holistic orientation which includes consideration of learning theory (abstract, theoretical, process), instructional theory, instructional development, and instructional delivery (concrete, applied, product). In order to further aid in media selection decisions, they present a discussion of the unique transmission characteristics of four modes of teleconferenced delivery: audioconferencing (good for discussions of

abstract concepts); audiographic teleconferencing (combination of verbal messages and visual materials provides both abstract and concrete learning experiences); videoteleconferencing (permits audio and visual interaction, thereby enhancing learner "satisfaction"); and computer conferencing (allows convenient transmission of text or graphics).

Course and curriculum development

Whether designing an entire curriculum, a single course, or a supplemental component of a course or unit, certain principles of instructional design must be incorporated into the planning to insure a successful teaching/learning experience.

Parker and Monson (1980) introduce the concept of "teletechniques," design components often taken for granted in face-to-face situations, but crucial to success of distance education experiences. The techniques which these authors contend must be incorporated into course development are humanizing, participation, message style, and feedback.

Humanizing refers to the creation of an accepting environment which breaks down the barrier of distance and generates feelings of rapport between teacher and students. Supplying student pictures to all sites and addressing participants by name are examples of easily implemented humanizing techniques. Participation deals with the extent of interaction among participants in the teleconferencing situation. Instructor enthusiasm and encouragement, site-to-site discussions, buzz groups, and role playing all encourage active participation. Message style refers to ways of enhancing the interest and appeal of a presentation. Planning for short instructional segments, varying tone of voice and volume, and supplementing programs with visual aids maintain the interest and attention of students. Feedback allows instructors to determine if their presentations were clear and effective. Both verbal and written feedback should be obtained, and can include questionnaires, interviews, or group reports (Parker and Monson 1980).

Hezekiah (1986) applies the concept of "teletechniques" to a credit course for nurses. Such elements, she contends, are necessary for the successful implementation of teleconferencing classes, and evaluation must be conducted to measure the extent of such success. Evaluation of each of the four elements is discussed from both the students' and the teacher's perspectives; overall administration of the course is also assessed from these perspectives. She concludes that these independent evaluations revealed similar as well as different concerns and

satisfactions, and offers nine recommendations for enhancing the teleconferencing experience for both students and teachers. Included in the recommendations are: purchase of increased learning resource materials for remote sites; visible, tangible support to instructors; availability of a toll-free number for use by students and faculty; and recognition by administrators that planning and implementation of teleconferencing courses requires greater expenditures of faculty time and effort than does that for traditional courses.

Assuming that the principles of effective teleconferencing are followed, what type of curricular offerings are appropriate to distance education formats? Even a cursory review of the literature reveals a wide variety of basic, supplemental, and enrichment programming offered at all levels of instruction.

The Arts and Sciences Teleconferencing Service, based at Oklahoma State University, began offering courses in German to high school students in 1985; they have since added Calculus, Physics, History, Government, Russian, Chemistry, Basic English and Reading, and Applied Economics. Classes are broadcast two or three times a week, with computer-assisted student activities under the supervision of local teachers occupying the remainder of the week. The local teleconference facilitators, who support student efforts, hand out materials, and serve as intermediaries with the master teacher, attend special training sessions designed and provided by OSU (Elliott 1989; Clark 1988).

In 1986, Eastern Washington University began broadcasting Spanish, Pre-calculus, Advanced English, or Japanese to eighteen school districts in eastern Washington. Two-way audio and one-way video signals were transmitted live via satellite to over two hundred students. Tests and homework were mailed to the university campus, where graduate students quickly graded and returned them. Each remote class was supervised by an on-site facilitator trained by the master teacher for the course (Batey and Cowell 1986).

Audioconferencing is used to provide basic programming in Nebraska. Sponsored by ISHS, the TeleLanguage program combines independent study and regular conference calls to teach French, Spanish, and German. Students in twenty-four school districts participated in 1987-88 (Wall 1985; ISHS 1988).

The Satellite Educational Resources Consortium (SERC) uses satellite and computer technology to delivery basic programming to secondary schools in eighteen states (Elliott 1989). Satellite, microwave and cable technology deliver instruction in Japanese, Russian, Probability and

Statistics, Discrete Mathematics, Advanced Placement Economics, and Science, Technology and Society. Students interact with instructors via telephone, computer, and keypad technologies.

As Clark (1989) points out, "distance education can include learning experiences other than full-fledged courses. Special broadcast events and projects...are also part of distance education." Second graders in Illinois have used live text-based conferencing to "talk" with a children's book author (Handler 1988). Using a microcomputer equipped with a modem and telecommunications software, they entered the Student Forum, part of the CompuServe Information Service, and joined other schools in the conference. Following set protocols, the students "raised their hands," waited to be "called on," entered questions on their keyboards, and were answered on-screen by the author.

SciStar Satellite's "The Shoulders of Giants" series provides enrichment events in which high school and middle school science students are able to interact with leading experts in fields such as paleontology, brain hemisphericity, superconductivity, and underwater archaeology (Clark 1988). Teachers who take part in SciStar programming along with their students can earn continuing education or graduate university credit by developing implementation plans for the programs (Elliott 1989).

In addition to providing basic educational programming, the TI-IN Network offers student enrichment programs on a variety of topics. "Japan: A Land of Contrasts," "Exploring Caves and Culture in Oaxzco," "Ecosystems News at Noon," and "Christmas in Mexico," are examples of current student enrichment classes. Programs on career counseling, drug and alcohol awareness, and SAT review courses are also available (Elliott 1989).

One final consideration important to course and curriculum development is the issue of who designs and evaluates courses. Downing, in her 1984 "Survey on Uses of Distance Learning in the United States" found that, of the fourteen states indicating systematic implementation of distance education, only one used teachers to design courses delivered via educational technology. The other states relied on a variety of sources: national consortia, university units, or independent vendors, for example. Downing (1984) expresses concern that the exclusion of teachers from the design process will result in distance education that is truly distant: removed not only from the presence of the learner but from the control and/or influence of the teacher, as well. Such a situation could have profound implications on the level of teacher commitment to any distance education program.

Use of telecommunications for teacher in-service training

Prevalance. South Carolina reports extensive use of television and radio broadcasts for the staff development of educators (Downing 1984). Topics offered include courses in adult education, career education, the arts, classroom management, computer education, early childhood education, teaching techniques, and television production techniques. Twenty-five per cent of broadcast time is devoted to certification renewal credit courses.

Oklahoma State University's Midlands Consortium Star Schools Project offers in-service programming for educators (Elliott 1989). Programs for April, 1989 included "Designing K-8 Learning Environments" and "Distance Education: Is The Sky The Limit?"

The Satellite Educational Resources Consortium (SERC) offers teacher training and in-service programming to instructors in member state or local education agencies (Elliott 1989). The following courses are scheduled to be offered during the 1989-90 school year: Advanced Placement Calculus for Teachers, Advanced Placement Economics For Teachers, Current Issues in Education, Teacher Training in Inquiry Based Science, Telecommunications for Educators, and Algebra I for Teachers.

TI-IN also provides teleconferenced training for teachers. Project members such as California State University, Mississippi State University, and Western University Illinois develop and offer credit courses in areas such as mathematics, science, and career and guidance training (Elliott 1989).

Levinson (1984) notes that students in vocational education programs in Iowa receive courses leading to certification via audiocassette and telephone. Another program in Iowa, the Physics Resources and Instructional Strategies of Motivating Students, and the Kansas State University Regents' Continuing Education Network also provide in-service teacher training via teleconferencing.

Effectiveness. Few studies have focused on the effectiveness of distance education for in-service training. Nunley (1965) discusses a study to compare the effectiveness of telelecture to face-to-face instruction for the retraining of mathematics teachers. Pre-tests and post-tests of achievement, mathematical ability, and attitudes showed a significantly greater mean change in content mastery for the group receiving instruction by telelecture than for the face-to-face group.

In another effort to determine the effectiveness of distance education for in-service teacher training, Kirman and Goldberg (1980) studied two groups of teachers instructed about Landsat satellite maps. One group received traditional face-to-face instruction while the other group was instructed via one-way television and simultaneous audioteleconferencing. Both groups had the same instructors and used the same materials. The majority of the teachers rated the teleconferencing method as either acceptable or desirable; however, a substantial minority felt the method was undesirable. Teleconferencing rated higher than face-to-face instruction for comfort and convenience, but lower for interactive elements. There was no significant difference in the two groups' perceptions of the effectiveness of either method for imparting knowledge.

Kirman and Goldberg (1980) then compared groups of students instructed by these teachers on the basis of their ability to interpret maps. They found that pupils taught by teachers instructed via teleconferencing scored significantly higher on a map achievement test than did those taught by the controls. They conclude that, although the presence of uncontrolled variables makes attributing differences directly to the mode of instruction impossible, it can be stated that teleconferencing is effective for imparting knowledge and skills.

Professional development needs of distance educators

Many of the authors reviewed have suggested that the success or failure of technologically mediated educational experiences depends to a large extent on the skill and commitment of the teachers and facilitators who are directing those experiences. The issue of how appropriate skills should be taught, and high levels of commitment encouraged, is important to the continued and increased success of technologically delivered educational programming.

Riccobono (1986), in a survey of schools of education and teacher training programs (undergraduate and graduate), examined the extent to which future teachers and administrators are trained in distance education technologies. He reports that 84 percent of the institutions surveyed offered training in the instructional use of computers, 64 percent in the instructional use of video, and 55 percent in the instructional use of audio technologies. He notes, however, that such courses deal primarily with operation of equipment (93 percent, 94 percent, and 95 percent respectively). Only 52 percent of the institutions offered training in the

management of small groups of students using computers, only 37 percent offered instruction in the use of live interactive TV for instruction, and only 26 percent offered courses in the use of audio technologies in instruction. When he examined the extent to which these particular courses were required, the percentages were considerably lower: 17 percent, 17 percent, and 13 percent, respectively. Riccobono's (1986) data provides strong evidence that those who will be asked to make distance education program design decisions, as well as those who must actually implement such programs, are not being trained at the early stages of their professional development. At what stage is such training taking place? Batey and Cowell (1986) contend that:

> With only a few exceptions, the best training is little more than a quick effort at the last moment before implementation or after problems have already appeared. Often teachers are left to grapple with the new programs on a "sink or swim" basis under the assumption that no training is required (p. 16).

Many of the reports reviewed mention the desire of instructors to receive early, appropriate training for these unfamiliar teaching experiences. Gilcher and Johnstone (1988) note that the most frequently received faculty suggestion was to provide them with more training on how to effectively use the technology to teach distant students. Benning (1985) reports that faculty members in the LearnAlaska Network also voiced a desire for appropriate and adequate preparation for distance teaching. Faculty-identified professional development needs in that program included:

- Notification of the amount of time needed to prepare and teach distance delivered courses;
- Instruction in methods to establish and maintain effective communication with distant students;
- Discussion of the experiences of other faculty members;
- Strategies for adding visual components to audio courses;
- Strategies for increasing interaction both among students and between students and faculty;
- Discussion of the planning and management of organizational details involved in distance delivery;
- Strategies to encourage group cohesion and student motivation.

The literature includes many examples of general and specific guidelines for training teleconference facilitators or teachers. Gilcher and Johnstone

(1988), in their review of the use of audiographics in educational settings, note that the "ideal" teaching/learning environment would provide instructors with training on both the technical aspects of the system and the strategies for teaching students at a distance. Additionally, teachers would have assistance in developing instructional graphics, and would be formally recognized and compensated by their institutions for the first time they develop courses for the telecommunications system. Weaver (1982) contends that:

> students are video and audio consumers and are constantly exposed to high quality production...They might not expect the same production values in a college credit course but they will get bored and lose interest quickly if some basic production values are not there (p. 293).

To encourage high quality programming, he suggests that faculty training workshops should:

- Acquaint instructors with the latest in instructional telecommunications equipment
- Provide instructors with a general understanding of the proper use of the various media for instructional purposes;
- Provide opportunities to practice using the technology for instruction;
- Discuss the potential problems involved in distance teaching.

In addition to appropriate training, professional distance educators must receive administrative support that reflects a belief in the importance of their efforts to become effective teachers-at-a-distance. Byerly, Steinhart, and Swinsick (cited in Gilcher and Johnstone 1988) describe the administrative support given to those receiving professional school-based in-service training for Pennsylvania's Teleteaching Project:

- Teleteachers will be provided seven days of substitute coverage in order that they may visit the satellite sites and receive advanced training.
- Teaching associates will be provided four days of substitute coverage in order that they may visit the transmitting site and other satellite locations and receive advanced training.
- Both teleteachers and teaching associates will be provided with appropriate travel funds.
- Teleteachers will visit other teleteachers once a semester.

Cost effectiveness of distance education

A determination of the cost-effectiveness of technologically mediated instruction is generally based on several considerations. The cost of educational telecommunication compared to the cost of traditional delivery (and to each other), potential savings due to lowered travel expenses or the hiring of fewer teachers, and the possibility of increased enrollments are a few of the factors which must be taken into consideration in any attempt to determine the extent to which distance education is cost-effective.

Staff at the AT&T National Teletraining Center have developed a model to assist clients in selecting media appropriate to their budget and needs. This spreadsheet model "incorporates charts, figures, and formulae based on industry-accepted values or other values determined by experts in the field of instructional technology" (Chute and Balthazar 1984). This model, with figures provided by the client, compares the basic costs of six delivery options on the basis of costs for equipment, maintenance, instructors, support staff, and delivery of instruction.

Another model for determining cost effectiveness is provided by Markowitz (1987). He discusses earlier studies comparing the cost of providing higher education at a distance to providing traditional higher education, and provides a framework for determining the "break even" point of a distance education program based on an analysis of fixed and variable costs.

Kullen (1984) discusses the hardware, distribution, and production costs of teleconferencing. She investigates the uses of teleconferencing in corporate and public settings, describes the various modes of teleconferencing available, and examines both intangible and quantifiable benefits offered by these modes of communication. Kullen goes on to present the benefits of both leasing and purchasing teleconferencing equipment or systems and advances suggestions for determining whether the cost of teleconferencing is a justifiable expenditure. She concludes that, if a long term perspective, influenced by both quantitative and intangible factors, is taken, many non-profit organizations will find that teleconferencing is an affordable, viable means of sharing information, disseminating research, or supplying programming.

Batey and Cowell (1986) suggest that the measurement and analysis of costs, an important component of the summative evaluation of any program, should include the following elements: a model for obtaining and analyzing cost information; determination of overall costs, component

costs, and per student costs; determination of the cost of alternative delivery methods; a record of all cost data, including "already paid for" costs; and a relating of costs to educational gains.

Christopher (1982) reports on a cost comparison study between the Teleteach Expanded Delivery System (TEDS) and resident instruction for providing needed instruction to Air Force students at remote sites. During a two year period, 2982 students (1247 at remote sites) were involved in this project. For the first year, system costs were reported at $272,421 and cost avoidance (based on estimated cost of transporting students to on-site training) at $795,829, resulting in a cost benefit of $523,408. In the second year system costs were $224,718 and cost avoidance $695,151 for a savings of $470,433. The two year, ten site program thus resulted in a total cost benefit of $993,841.

The cost-effectiveness of delivering 5377 contact hours of continuing education to professionals via audio teleconferencing was examined by Showalter (1983). Cost savings were based only on travel costs; food and lodging were not included due to the variability of estimates. Researchers computed that during the project 282 consultants would have traveled 519,958 miles to deliver 991 hours of face-to-face instruction. The estimated cost for this travel (at $0.31/mile air fare or $0.21/mile by automobile for distances under 400 miles) was $156,271. The actual cost of teleconferencing was $69,635. The savings of $86,636 represented a 55 percent cost benefit.

In 1986, AT&T realized significant cost savings resulting from the avoidance of travel costs and productivity related costs (Chute, Hulik, and Palmer 1987). During that year 3176 students attended teletraining sessions. Without such sessions, students would have had to travel to Cincinnati to receive training. Estimated savings from travel, meals, and lodging were $500 per student per course, for a total savings of $1,588,000. Avoidance of non-productive time for students (estimated at six hours per student) saved an additional $457,300. The company incurred teletraining costs of $234,900. Total cost benefits realized were $1,810,400 for one year.

Ellertson and associates conducted a national survey on the cost effectiveness of distance learning in the schools (Ellertson, Wydra, and Jolley 1987). Responses received represented thirty-four classes serving 812 students in forty-seven schools. Equipment startup costs ranged from $3000 for one type of audiographics system to $60,000 for microwave. Transmission costs ranged from $75 to $966 per course per month. While teacher costs were relatively constant, the cost of paying monitors

varied greatly, depending on whether or not certified teachers were required to supervise students at remote sites. In fifteen of the thirty-four classes, the cost per student for the distance delivery system was shown to be lower than with a live teacher. In most cases, the courses would not have been offered in the traditional format.

Ellertson provides the following recommendations for improving the cost effectiveness of distance education: 1) lower transmission costs by using voice/data modems, dedicated lines, call-forwarding, and toll-free lines; 2) increase the number of participating sites; 3) increase the number of courses per day; 4) lower the cost of monitors at remote sites by using paraprofessionals; 5) increase the number of students; 6) lower the startup costs (use audiographics instead of microwave); and 7) keep the cost of the teacher low by having students at the originating site.

Rule, DeWulf, and Stowitschek (1988) describe a three-year federally funded model and demonstration project for providing inservice training via video teleconferencing supported by an electronic mail system. In order to provide an accurate picture of the cost effectiveness of developing and maintaining this program, the researchers developed a model of economic analysis of videoteleconferencing based on a comparison of the actual costs of this project and the estimated costs of an equal amount of face-to-face training. No comparison of the educational effects of each alternative was made.

During Year One, training via videoteleconferencing was provided to one site; an additional site was added during years Two and Three. Training, development, monitoring, and evaluation costs (combined under the terms "training costs") included costs for personnel, travel, office supplies, operations and equipment, and routine communications between staff at each site. Actual costs of teletraining were used to estimate face-to-face training costs. Costs for personnel time, travel, and supplies were included in the estimate.

This study reports that during Year One, in which only one site was used, costs for teletraining and face-to-face training were almost identical ($29,246 vs. $29,863). During the next two years, however, when additional sites were added and system charges decreased (due to sharing with other users), teletraining resulted in major cost savings; the costs were $30,718 vs. $62,077 for Year Two and $18,148 vs. $55,404 for Year Three. The conclusions in this report are supported by detailed graphs and tables which present actual and estimated costs of each aspect of the program (personnel, travel, supplies, telecommunications, routine communications, and site costs).

State policies dedicated to distance education

Various states began to develop policy concerned with distance education in the early 1980s. Many are informed by "inventory studies" and recommendations to a planning process. In some states, the inventory is the single document and policy has not yet followed. Obviously, with exponential change in distance education technology and countless institutions within and outside each state engaged in the new delivery of new programs, inventory reports are quickly outdated. A second policy type which emerges is an in-state coordinating "procedures policy" intended to enhance resource sharing and duplication of service.

States which have developed such seminal policies are listed below, but it is significant to note that each has tended to work in general isolation from the other.

Inventory studies. The following are reports in which states have attempted to categorize the scope and range of their in-state activities; most include recommendations on specific, often regulatory issues concerning out-of-state program delivery (England 1990):

- The Florida Satellite Network Study: Report and Recommendations of the Florida Postsecondary Educational Planning Commission (1985) has been a basis for policy development in Florida and provides a comprehensive, detailed analysis of systems in existence in Florida.
- The Coordinating Board of Texas College and University System studied the use of telecourses in 1983 and the Board adopted exemptions, rules and regulations, and standards for televised instruction in January 1985. The need for institutional plans, self study and a statewide review is also discussed.
- In August of 1988, the Missouri Coordinating Board, received recommendations from a task force of its institutional representatives to facilitate policy development. Among the recommendations was a call for a further study.
- Minnesota reviewed state-level higher education policy and, in 1986, developed regulatory policies for out-of-state programs together with policies addressing funding, faculty development, courseware development and protection of property rights when technology is used in distance education (Minnesota Higher Education Board 1986).

- Oklahoma State Regents for Higher Education adopted a broad policy statement in 1981 addressing credit course offerings by electronic or other non-traditional means. This was enhanced in 1985 with a report on the development of an educational telecommunications network by the Division of Educational Outreach of the State Regent Board. In February, 1988, The Regents approved the *Policy and Procedures Pertaining to Off-Campus Programs, Electronic Media, and Non-traditional Methodology* providing a basis for authorization, purpose, standards, planning coordination, fiscal provisions, reporting and guidelines for telecourses (Oklahoma State Regents for Higher Education 1988).

Policies. The Minnesota and Oklahoma policies are both inventory studies and policies regarding procedures, since they deal with authorization/regulation as well as fiscal provision, faculty development and coordination. Other states have sought to emphasize these elements even more, as seen below:

- As early as 1977, the West Virginia Board of Regents addressed the rights and responsibilities of television teaching (in Bulletin No. 48) (West Virginia Board of Regents 1986). Their more recent *Study of Cooperative Lines of Telecommunications Systems in West Virginia* makes recommendations to strengthen and enhance relationships and cooperation among the major providers of distance education in the public sector.
- The Kentucky Educational Television (KET) system and the Kentucky Council on Higher Education established the Kentucky Telecommunications Consortium in 1978. Its primary purpose was to coordinate college credit telecourses in a cost-effective system and, as a result of this policy, it has grown from 848 students in 1978 to 4,700 in 1987/88 and today is seeking greater access and resource sharing among consortium participants (Kentucky Council on Higher Education 1988).
- Maryland's higher education authority has established the Maryland Educational Video Network and the Maryland State Board for Higher Education has recommended the establishment of an Advisory Board on Instructional Technologies to address and coordinate the issues arising in distance education (Maryland State Board for Higher Education 1987).

- Virginia, like Oklahoma, has bridged both regulatory and developmental policy. The State Council for Higher Education completed its Report on Telecommunications by the Task Force on Telecommunications in 1987 (State Council of Higher Education for Virginia 1987a). It strongly recommends colleges and universities to accept telecommunications delivery as the primary delivery mode. Since that time, The Regulations Governing the Approval of Certain Institutions to Confer Degrees, Diplomas and Certificates have been effective in Virginia to govern out-of-state institutions delivering courses in Virginia, including those by distance education means (State Council of Higher Education for Virginia 1987b).

National institutional policy development. At least two major initiatives require recognition at the national level—both fostered by nonprofit ventures:

- The 1984 *Project ALLTEL: Statement on Accreditation and Authorization of Distance Learning through Telecommunications* is a landmark in national policy (State Higher Education Executive Officers Association and Council on Postsecondary Accreditation 1984). This report was supported by the Fund for Improvement of Postsecondary Education and developed by the Council on Postsecondary Accreditation (COPA) together with the State Higher Education Executive Officers Association (SHEEO). It has provided the focal point for state discussion and action, especially in its Joint Statement of the Accreditation, Authorization, and Legal Task Forces on Assessing Long Distance Learning Via Telecommunications. It seeks efforts among states to enhance their communication and sharing, and to ensure the quality of programs as well as coordination across states.
- The more recent *Adult Learning/Information Technologies: A Survey of Public Broadcasting in the West* by the Western Interstate Commission for Higher Education (WICHE 1985) is based on a survey of public broadcasting in western United States. This document, in turn, initiated a 1987 statement on policy issues: State Higher Education Policies in the Information Age (WICHE 1987). It addresses policy issues for institutions, state-level agencies, regional agencies, and accrediting agencies.

Implications

General

The weight of evidence that can be gathered from the literature points overwhelmingly to the conclusion that teaching and studying at a distance, especially that which uses interactive electronic telecommunications media, is effective, when effectiveness is measured by the achievement of learning, by the attitudes of students and teachers, and by cost effectiveness.

To this optimistic conclusion it is necessary to append several reservations. The sheer weight of opinion in the literature should not be taken as conclusive of itself, since most of it is based on anecdotal evidence offered by persons and institutions with vested interests in the techniques being evaluated, or in the very programs they are evaluating. Furthermore in those studies where some attempt has been made to gather empirical data, the research has been undertaken by schoolteachers or university faculty with extremely limited resources. As a result, the methodology of many of the research designs is weak, with regard to such factors as the populations being compared or otherwise studied; the treatments being given, the statistical techniques being applied, and the validity, reliability and generalizability of the data on which the conclusions are based.

It is also very important to distinguish between conclusions that may be reached on the basis of evaluation research, which is the kind of research that has provided the most evidence for the optimistic conclusion above, and basic research, of which there has been very little. The difference in the purposes of the two kinds of research is made clear in the following statement about evaluation projects in distance education:

> ...it is unlikely they were done with a research focus in mind and as a result probably have little in the way of external validity, and are not linked to existing research..., and perhaps do not reflect an interest in providing information for anyone not connected with the program being evaluated....[Such evaluation research] is not typically concerned with prediction or control of variables that generalize beyond the primary setting and as a result can often be done less expensively than research for the overall improvement of a given system or institution (Coldeway 1988).

To support the conclusions from experience, anecdotal reports and evaluation research, an immediate and vital need is to develop a program of research that will be generalizable beyond the primary setting, and that will give the power to predict and control variables in the distance education environment. To bring about this kind of research it will be necessary to develop a total systems model, and then to develop and integrate knowledge about the distant learner, teacher, administrator, social system, and communications technology.

It also has become apparent that research is urgently needed into the procedures by which states are forming their policies with regard to distance education, and what those policies are.

The primary conclusion of the reviewer is that there is a strong prima facie case for believing in the effectiveness of distance education through interactive telecommunications; that the implications of this for the future overall improvement of the states' and the nation's educational systems are so promising as to warrant investment of money, time, and human resources in a thorough, integrated national research program. This program should not only evaluate existing projects, but should institute a series of projects of rigorous research design to measure the fundamental dynamics of learning and teaching by telecommunications and its most effective organization, as well as the procedures and nature of policies regarding the development of such education.

As a rider to the above conclusion, it is suggested that where funding is provided for further implementation of distance education it is only on condition that well designed and adequately funded evaluation is proposed as part of the submission for funding.

Some of the directions that research, both basic and evaluation, might take will be indicated in the remainder of this report. This is not intended to be exhaustive, however, and it is suggested that at an early stage an exploratory research group might be established to develop a research model and begin to specify the main research needs more formally.

The need for strategic planning

Orderly, well planned, introduction of distance education through interactive telecommunications, and its successful implementation, is threatened by the too-cautious interpretations of distance education by many long-established educational administrators. On the other hand it is threatened also by overselling and well intentioned "hype" from the

communications industry, where each vendor has a product that is potentially useful to the educators, but only as part of a total educational system that is beyond the understanding of the sales person. The vendor's enthusiasm for one product, impacting on busy educational administrators and other decision makers who are also not well informed about distance education as a total system, can result in schools or school systems purchasing partial technologies. These are technologies that are good in themselves, but of reduced effectiveness because they are not part of any well thought out, integrated, system and therefore do not fit with other technology, the teacher cadre, medium and long term curriculum or instructional planning. They therefore fall short of their potential.

There is need for state, and national STRATEGIC planning, planning that cannot be done on a small scale by local administrators, though representatives of schools will have an important part in the planning, and an equally important part in the next, local, planning stages and in the implementation of such plans.

The current, pluralistic approach, with the resulting conceptual, research and implementational anarchy is neither in the interests of education nor of the telecommunications industry. This leads to the following conclusion: establish education-industry planning teams at national, state and local levels to plan and implement the establishment of integrated delivery systems, and determine telecommunications needs and select hardware as part of education-driven total systems.

Implications regarding learning

While there is considerable evidence of the effectiveness of distance education in bringing about learning, many questions remain unanswered. Many of them can be subsumed under the research paradigm of Treatment X Learner Interaction. While there is evidence, either anecdotal, such as the casual observation of school teachers or principals, or post-hoc measures on single groups, there are few studies that discriminate methodically among the different types of learners who learn successfully. Most K-12 projects have targeted "gifted" learners, but there have been too few with "mainstream" learners, or "special" or slower learners. Besides this crude distinction based on previous school achievement, learners should be distinguished by such variables as personality and socio-economic characteristics, to ascertain the significance of individual differences in learning achievement. Within the teleconference family of communications various teaching techniques are, or should be employed. Which of these do learners most prefer, and what

type of learner prefers and learns best from each technique? Besides such "within groups" research there is even prior need for controlled "between groups" research with some effort at randomization of subjects, since the data presented so far has been either of single group evaluations, or where comparisons have been made, there have been systematic biases in the constitution of the groups studied.

Implications for teachers and teaching

Research is likely to show that there are individual learner differences in response to distance education and its various techniques, as there are to classroom instruction, to particular teaching styles, even to particular teachers. In general, it seems likely that good teaching by teleconferencing and other distance education techniques has results no better or worse than good teaching by any other method, including good face-to-face instruction.

However, the highly artistic teacher who is also advanced in a content area and able to "keep up" is rare, and distance education can distribute the work of such master teachers to large numbers of children who otherwise have to settle for the more ordinary. In other words, the best of distance instruction is superior to average classroom teaching. However, distance education requires a division of the activities of teaching to allow each teacher to specialize in such activities as developing course content, managing course design, developing and applying evaluation instruments, and giving individual learner support, and the special skills of facilitating interactions by teleconference. Existing teachers and teachers in training are well able to acquire these, but in the majority of projects so far they have not been given the opportunity. There is some evidence that the success of distance education in the schools depends largely on the effectiveness of the teacher, and that this in turn depends on the teacher's knowledge, skill, enthusiasm, and commitment to the innovation. It therefore becomes important to review the extent and quality of teacher preparation and in-service training in distance education, as well as the terms and conditions under which the teacher is expected to operate.

Training opportunities in distance education are desperately limited. Most in-service programs that deal with technology seem to center on how to run equipment with little attention to the more important aspects of how to incorporate technology into instruction, and virtually none into the concept and practice of distance education, i.e., a different organization as well as techniques of instruction.

Ultimately it is pointless to organize distance education projects if training cannot be given, since failure demoralizes the teacher, perhaps harms the students, and gives an otherwise promising new approach to education a bad reputation.

It is probably not advisable to permit vendors of either hardware or telecommunications services, including educational programs to conduct training, since they are not impartial in the advice they will give on selecting media and programs for particular students, schools, and content. A national training program should be set up. Most training of experienced teachers could be done "on the job" in the teachers' schools. Training of trainers could be coordinated around a limited number of centers of excellence at selected universities.

Training will include: course design and curriculum development in distance education; skills and techniques of writing and recording teaching for both particular media and for the integration of media, including working in design and presentation teams; the production of written, recorded and teleconference teaching; planning and managing distance education systems at local, state, and national levels; techniques of facilitating interaction; research and evaluation techniques; student support and counselling.

The attitudes of teachers and others who have given their professional lives to education also deserve attention. In particular there is a natural concern that technology will replace them in the classroom. Distance education generally, including teleconference education should not replace teachers. It may alleviate them of certain teaching tasks, to free their time to give better attention to others. It is important for teachers-in-training to be stimulated to a positive attitude to technology as a means of enhancing the quality of the human interaction that is important in education, and not to see technology as a dehumanizing influence. For the teacher in service it seems likely that commitment will be a function of involvement in decision-making about the use of new technology, training in its use, and reward, or at least no penalty in such matters as job security, salary and time allocated to work. Teacher representatives need to be involved in both research planning and policy making.

Implications for media selection and usage

It is very important, and difficult because of the generally low intellectual and aesthetic quality of broadcast television in this country,

that when electronic media are used in education they exhibit high standards of content as well as production values. There is frequent confusion of the purpose of using the media in education with their use in entertainment and advertising, and it is vital that influences from these areas do not overwhelm the values and purposes of educators. Educators must remain in charge of distance education, and research is required into a number of questions concerning the selection and educational use of these media. One of particular importance is that of the relative effectiveness of each medium for particular teaching tasks. In their enthusiasm for electronic media some educators overlook the critical importance of print and the written word in the achievement of most educational goals. There is little doubt that almost every distance education program requires, or is greatly enhanced by a study guide and readings of various types. The recorded media should be considered for the use of the students in their own time, under their own control. The fast, spontaneous interaction of the teleconference is not always the form of communication most appropriate for a particular learning objective. Research is needed to determine which learning needs are best met by which particular media, and in program development the applications of this research must by applied. It is critically important that media are only selected to meet defined learning needs, and it is wise to bear in mind that many learning needs that are currently the subject of very expensive media can probably be met by less expensive, less glamorous media. The power of print, recording, and the telephone should never be underestimated. Numerous research questions need to be asked concerning the ways in which media are selected. By whom are they selected, and by what criteria? We also need to ask what training is given to the administrators and other decision makers who make these selections.

Implications concerning the quality of interaction

Facilitating interaction by telecommunications in education is an art that is different from the art of broadcasting or even of conducting a teleconference meeting of business persons on the one hand, or of conducting interaction in a classroom on the other. The key to the art is that the teacher actively USES the interactive nature of the media, resisting the temptation to lecture, which is better done through the recorded medium, and bringing learners frequently, indeed almost continuously, into action by asking questions, encouraging student presentations, getting students to talk to each other, and in other ways involving them

fully in the teaching/learning process. Further research and an emphasis in the training of teachers is needed concerning the techniques of facilitating interaction. There is some disagreement concerning the need for on-site facilitators. However, until research suggests when such helpers may be needed, for which learners and what content, prudence would suggest they are provided whenever possible. They must be trained to aid the distant instructor, and not replace the instructor's role, but they can provide assistance to learners at their sites, and help in individualizing content.

Implications for educational systems and organizations

There is no identifiable pattern concerning successful and unsuccessful adoption of new technology. Research is needed concerning the sociology of successful adoption of new technology by schools and other levels of organization of education. This is likely to be based on theories of adoption/diffusion. What are factors leading to successful adoption in places, rejection in others? It is suggested a survey reviews projects in all fifty states to identify reasons for success and failure. One hypothesis suggested by the literature is that success depends on the extent to which there is a transfer in the motivation for the project from that of external funding to internal commitment by the teachers. If this is so, it further reinforces the importance of teacher attitudes and teacher re-training.

Implications concerning documentation

The rapid expansion of distance education in the United States and in other countries has been paralleled by an expansion in the volume of literature and data emanating from distance teaching institutions. Potential users of such literature and data come from a variety of areas within distance teaching institutions, and from institutions not currently teaching at a distance. The sources of many of these types of information are not held by conventional libraries since they are either unpublished or semi-published. The most effective way of storing and making available the literature and data on distance education is through a separately administered documentation center. Several nations around the world have now established such centers, most notable of which is the International Documentation Center based at the Open University in Great Britain with a special responsibility to gather documentation for

the new Commonwealth of Learning throughout the British Commonwealth.

Establishment of an American Distance Education Documentation Center would provide a valuable clearinghouse for practitioners and policy makers in this country and would also become part of the world-wide network of documentation centers now being established. This will have the added benefit of facilitating international exchange and cooperation between distance education practitioners and policy makers, and scholars in this country and their counterparts in other countries.

Implications concerning policy formation and policy research

Federal, state, and local policies with regard to distance education have only begun to emerge in the past decade, and have not kept pace with either the pace of change in communications technology, or even the response of educators to the new teaching-learning opportunities opened up by the new technologies. Policy research has meant little more than occasional studies and recommendations to planners, aimed at the development of procedures for coordination and regulation, with consistent concerns being: accreditation and regulation of credit programs delivered by distance education, especially out-of-state delivery; funding of such delivery; enhancement of resource sharing and cooperation among institutions; reporting and accountability issues; and, in a few cases, faculty development.

Conspicuously absent is a policy role by the Federal Government. Also absent is any process to establish clear linkages among institutions, state, intra-state, regional, and federal level policy makers. It is also notable how few academic or higher education organizations have entered the field to research the issues of policy formation in distance education.

Against this background the following questions are proposed for research at an early stage:

1.What processes, procedures, or structures for determining policies might prove effective for developing a multi-level interchange among major institutional providers, leading states, key non-governmental agencies, and federal agencies to oversee the orderly development of distance education?

This question assumes both a regulatory function respecting issues of standards, accreditation, and state and institutional legal obligations as well as developmental functions enabling resource sharing, sharing of

formative and summative evaluation, faculty and course development, learner support, and counselling services, etc.

The question might be addressed in the first instance by studies of policy making procedures in other countries, especially Great Britain, Canada, and Scandinavia, where distance education has achieved a well-integrated position in the educational system. The question could also be addressed by looking for examples of such inter-institutional collaboration in areas of large scale national need outside the education sector.

The establishment of an American Distance Education Documentation Center would contribute to the dissemination of policy documents which would be a contribution to informing the states about recent policy developments as well as key policy research issues.

2. What should be the role of the Federal Government, states, not-for-profit and other institutions in the further development of distance education?

This question asks who is to be given the leadership responsibility in what ought to be large scale, and therefore multi-institutional, multi-regional, sometimes global program development and delivery. One or two organizations like the Annenberg/CPB Project and the Star Schools consortia have filled the vacuum until now. Studies of the views of policy makers and others are needed, as well as perhaps studies of the effectiveness of organizations like the above, to resolve whether non governmental organizations and foundations could or should provide the major funding for distance education, or whether as in other countries this is to be publicly funded. If it is left to philanthropic organizations, how can federal and state objectives for education be protected?

3.What are the current perceptions and expectations for the future of state, federal, and non-governmental policy makers?

This question seeks to understand the current and future directions distance education will probably take, based on the visions held by policy makers across government and key distance education organizations. To what degree do they want distance education to be an alternative to conventional education? To what extent to incorporate and to what extent to be incorporated into conventional education?

4. How can researchers and policy makers arrive at a prioritized research agenda to mutually inform and investigate key issues?

This question echoes two earlier statements, one on the need for a strategic national research planning group to determine research priorities, and the other the need for strategic, national planning of the development of distance education programming. Here the emphasis is on reaching

agreement about research needs between the parties involved in policy formation and policy research. The question asks how research and dissemination of research can be organized to inform and guide policy across states at the federal as well as non-governmental level and asks how a mutually supportive prioritizing process can be arrived at. Unless practitioners, policymakers, and policy researchers can be organized to collaborate in this way the current duplication of effort and use of resources is likely to continue, but on a much larger scale.

5. How can distance education be used for the benefit of special target groups in society?

Unless special policy decisions are made and implemented there is danger that the potential for access to learning and its benefits offered by distance education will devolve to those who are already most capable and comfortable in accessing and using print and electronic systems. While the already educated and those able to afford technology may, as in the past, be the primary beneficiaries of education, the illiterate adult, the marginalized minority, the undereducated learner, the non-English speaker, the poor, may experience less access than ever.

What policies have been instituted to deal with this danger? How successful are they? What policies might deal with the problem? Who is thinking about this? What can be done about this?

Conclusions regarding policy

It is essential, before further large sums of money and effort are expended, while distance education is still in its formative growth stages, that infrastructures and on-going processes are set up to provide reliable information to policy makers. These might include the following:

1. A consultative mechanism in which federal and state policy makers can work out and coordinate a more proactive leadership position with regard to the facilitation, and not merely the regulation, of distance education, especially with regard to the rationalization of the use of resources, human and technical.
2. A national and also state strategic planning groups to prioritize needs, with a strategic plan for policy research receiving first priority.
3. Establishment at one or more leading research institutions of a program of coordinated investigative research on the national policy implications of distance education, and equally

importantly, a program to identify, gather, manage, and disseminate documents on distance education policy and practice.

4. An investigation of international distance education policy experiences and research that provides information about the success of policy in other countries. Besides the immediate contribution to U.S. development it must be born in mind that international education by distance education is now evolving, and several countries have recognized the foreign policy implications of this internationalization of education. The U. S. is in danger of being left behind in this regard.

Conclusion

The gap between educational needs and educational provision in this country is wide, and there seems little hope that it can be bridged by traditional means. In communications technology, correctly applied, it seems likely we have a way of bridging the gap and of solving many educational problems that themselves are a result of the technological age. However, the gap between the potential of distance education that uses communication technology and its application in American education is also wide. There is even a wide gap between the use of distance education in other countries and its use in the United States. There is opportunity in distance education that is not being taken advantage of. The review of literature reported in this paper leads to the conclusion that we have the means to open educational opportunity to more learners and to improve the quality of education for all, including lifelong, continuing education to the adult population. We can say with considerable optimism that when the distance education approach is correctly applied, it works well. Now it is time to move on from the period of small scale, uncoordinated and not well designed experimentation, too little coordinated planning of courses, too little cooperation in using delivery systems, too little over-all thinking by policy makers at state and national levels. It is time for large scale, coordinated research, large scale, well funded course design and delivery; well integrated, multi-media delivery systems, and state, inter-state, and national policy making and planning.

Annotated Bibliography

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Facilitators' manuals for persons coordinating receiving sites for teleconferences. Manuals produced for each content area include a planning calendar, technical information, suggestions for promotion and administration, program specific information, and materials about presenter, content, advertising, and program format.

AT&T Long Distance Learning Network. 1988. Informational materials. Basking Ridge, NJ: AT&T.

Describes AT&T's efforts to provide educational programming via distance delivery to students in six different countries.

Barker, B. O. 1987a. *Interactive Distance Learning Technologies for Small Rural Schools: A Resource Guide.* Las Cruces, NM: ERIC Clearinghouse on Rural Education and Small Schools.

Discusses distance education technologies as a cost-efficient means of providing rural schools with qualified teachers. Describes and provides examples of the implementation of satellite transmissions, two-way interactive television, Instructional Television Fixed Service (ITFS), audio-graphic teleconferencing, and multi-media equipped buses for mobile learning. Suggests that points for consideration include initial equipment costs, annual subscription or programming fees, maintenance/warranty contracts, and the experience of others who have used distance learning technologies. Report includes addresses and telephone numbers of 22 programs currently using these technologies.

Barker, B. O. 1987b. The effects of learning by satellite on rural schools. Paper presented at Learning by Satellite Conference, Tulsa, OK, April 12-14. ERIC, ED 284 693.

Discusses the use of interactive instructional television satellite systems as a means of resolving teacher shortages and meeting

state-mandated program requirements in sparsely populated areas of the United States. Benefits identified include equity and increased quality of educational opportunity; access to more diverse course offerings; interaction with other schools or with subject-matter experts; and increased opportunities for professional development and in-service training. Describes the four instructional satellite systems currently serving high school students (Texas's TI-IN; Oklahoma State's Arts and Sciences Teleconferencing Service; Utah's Accelerated Learning of Spanish Program; and Eastern Washington University's Telecommunication Project) and discusses the interest shown by other states in implementing similar networks.

Barker, B. O., and S. Logan. 1985. Small high schools curricula: Alternative delivery systems for meeting essential elements. Paper presented at the Annual Conference of the Texas Association of Secondary School Principals. ERIC, ED 252 371.

Suggests that non-traditional approaches to educational delivery may be necessary for small high schools to meet students' instructional needs and to comply with mandated curriculum requirements. Alternatives include cooperatives, contracting, interactive television, computer-assisted instruction, and adjusted school day or week. Presents examples of specific applications of various approaches and addresses of contact persons for each project.

Bates, A. , ed. 1984. *The Role of Technology in Distance Education.* London: Croom Helm.

Introduction provides an overview of general developments in distance education and specific developments in technology including increased variety of media, greater diversity of access, lower costs, and greater student autonomy and interaction. Individual contributers discuss media in course design, media in course management and presentation, and selection of technology.

Batey, A., and R. N. Cowell. 1986. *Distance Education: An Overview.* Portland, OR: Northwest Regional Educational Laboratory. ERIC, ED 278 519.

Provides an overview of distance education, including discussions of benefits (equity, increased program quality, and increased access); examples of distance education projects; and effectiveness. Also discusses key issues and concerns relating to curriculum development, teacher training, student support, certification and accreditation, management and scheduling, costs, funding, evaluation, and program integration. Appendix includes information on delivery cost and contact information for programs described in the report.

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Lists results of LearnAlaska faculty survey. Discusses faculty, examined barriers to successful programming, benefits of distance delivery, and professional development needs of audio lecturers.

Benson, G. M., Jr. and W. Hirschen. 1987. Distance learning - New windows for education. *T.H.E. Journal* 15(1):63-67.

Describes the application of telecommunications technology to distance learning. Technologies discussed include cable transmission, audio-graphic teleconferencing, microwave transmission, Instructional Television Fixed Services (ITFS), and satellite transmission. Suggests that telecommunications can meet the challenge of serving rural populations, offer innovative and inexpensive communication for the homebound, provide "electronic field trips", cut the need for faculty travel, and allow the sharing of educational resources among various locations.

Bevan, D. 1983. Making teleconferencing stick. In *Teleconferencing and Electronic Communications II*, eds. L. Parker and C. Olgren, 250-253. Madison, WI: University of Wisconsin-Extension, Center for Interactive Programs.

Provides suggestions for enhancing user acceptance of teleconferencing. Discusses user reaction in terms of uncertainty, stress,

and the need to change. Presents strategies for assisting users in making attitudinal and behavioral changes necessary to see teleconferencing as a non-threatening communication tool.

Blackwood, H., and C. Trent. 1968. *A Comparison of the Effectiveness of Face-To-Face and Remote Teaching in Communicating Educational Information to Adults.* Manhatten, KS: Kansas State University, Cooperative Extension Service. ERIC, ED 028 324.

Presents results of a study to determine whether audioteleconferencing is an educationally effective means of delivering educational information. Reports that there was no difference in the amount learned by telelecture and by face-to-face teaching, and that there were no associations between the amount of learning which occured via each method and the variables of age, level of education, time of day, and attitude.

Bond, S. L. 1987. *Telecommunications-Based Distance Learning: A Guide for Local Educators.* Research Triangle Park, NC: Southeast Educational Improvement Laboratory. ERIC, ED 287 474.

Provides an overview of telecommunication-based educational technologies and offers guidelines for their implementation. Discusses the rationale for distance learning, presents educators' experience-based conclusions and evaluations, and suggests strategies for implementation. Technologies described and evaluated include: instructional television, satellite broadcasting of live or taped instruction, Instructional Television Fixed Service (ITFS), and audioteleconferencing.

Boone, M. E. 1984. Examining excellence: An analysis of facilitator behaviors in actual audio teleconferences. In *Teleconferencing and Electronic Communications III*, eds. L. Parker and C. Olgren, 218-222. Madison, WI: University of Wisconsin-Extension, Center for Interactive Programs.

Attempts to "operationalize" some of the more ambiguous, yet essential, skills necessary for facilitating audioteleconferences. Reports that analysis of tapes of actual teleconferences provides specific examples of such skills. Skills deemed essential

include: ability to provide structure; ability to provide socio-emotional support; ability to establish a democratic atmosphere; ability to create a sense of shared space; ability to model appropriate behavior; and ability to "repair" sessions threatening to go awry.

Boone, M. E. , and R. E. Bassett. 1983. Training people to audioconference: A review of the current wisdom. In *Teleconferencing and Electronic Communications II*, eds. L. Parker and C. Olgren, 333-340. Madison, WI: University of Wisconsin-Extension, Center for Interactive Programs.

Provides a synthesis of literature on training for audioteleconferencing. Identifies necessary user skills, reports the results of a study to verify literature on user skills, identifies training methods, examines considerations in the implementation of training programs, and demonstrates the need for empirical assessment of training effects.

Boswell, J. J., D. W. Mocker, and W. C. Hamlin. 1968. Telelecture: An experiment in remote teaching. *Adult Leadership* 16(9):321-322, 338.

Compares the results of remote teaching and traditional face-to-face instruction in three classes of Introductory Psychology. Reports that pre- and post-test results showed no significant differences in mastery of content, and that student course evaluations showed no difference in student attitudes.

Braucher, B. H. 1983. Teleteaching: Interaction on a shoestring. In *Teleconferencing and Electronic Communications II*, eds. L. Parker and C. Olgren, 64-72. Madison, WI: University of Wisconsin Extension, Center for Interactive Programs.

Describes a program for providing instruction via audioteleconferencing to junior high school and high school students who are unable to attend regular classes. Discusses the prerequisites for effective teleteaching, including setting a receptive atmosphere, selecting words precisely, effectively using silences, and easing the transition to telelearning. Contends that the results in teleteaching classes are often superior to those in traditional classes

because the very simplicity of the system heightens interaction between participants.

Bronstein, R., J. Gill, and E. Koneman. 1982. *Teleconferencing: A Practical Guide To Teaching By Telephone*. Chicago: American Society of Clinical Pathologists Press.

Provides advice on how to design and implement audioteleconferencing programs. Discusses aspects of program planning including budgeting, equipment design, appropriate teaching techniques, use of visual materials, and evaluation.

Chapanis, A. 1976. *Human Factors in Teleconferencing Systems: Final Report*. Baltimore, MD: Johns Hopkins University, Department of Psychology. ERIC, ED 163 902.

Summarizes the main findings of nine experiments on human factors in telecommunications and teleconferencing. Discusses 1) how people naturally communicate to solve problems of various types, 2) how interactive communication is affected by technological devices and systems, and 3) what systems and human variables affect interactive communication. Concludes that some communication tasks common in educational settings, such as exchanging information or opinions, problem-solving, and generating ideas, are as effectively carried out in electronically mediated situations as in face-to-face situations.

Christopher, G. R. 1982. The Air Force Institute of Technology--the Air Force reaches out through media: An update. In *Teleconferencing and Electronic Communications*, eds. L. Parker and C. Olgren, 343-344. Madison, WI: University of Wisconsin-Extension, Center for Interactive Programs.

Describes the Teleteach Expanded Delivery System (TEDS), a system for providing instruction to students at remote sites in eight states. Discusses the evaluation of the program for educational effectiveness, acceptability, and cost. Concludes, on the basis of statistical analysis of test scores, that students learned at least as well as resident students; that student response was

positive, especially for shorter courses; and that the program was cost effective, showing a savings of $993,000 in two years.

Chute, A. G., and L. Balthazar. 1988. *An Overview of Research and Development Projects at the AT&T National Teletraining Center.* Cincinnati, OH: AT&T National Teletraining Center.

Report of the findings of AT&T studies designed to increase the understanding of psychological, socioeconomical and environmental factors relating to the use of teletraining as a medium for distance education. Presents research results on instructional effectiveness and cost-benefits, discusses course and curriculum development, and describes media characteristics and system implementation.

Chute, A. G., K. K. Bruning, and M. K. Hulick. 1984. *The AT&T Communications National Teletraining Network: Applications, Benefits, and Costs.* Cincinnati, OH: AT&T Communications Sales and Marketing Education.

Describes research conducted by AT&T comparing traditional and telecommunications delivery in terms of student achievement. Reports that while the pre-test scores of the two groups were similar, post-test scores of the teletrained group were significantly higher.

Chute, A.G., M. Hulik, and C. Palmer. 1987. Teletraining productivity at AT&T. Paper presented at International Teleconferencing Association Annual Convention Washington, D.C., May 5. Cincinnati, OH: AT&T Communications.

Reports the teletraining results in three corporate programs: Sales and Marketing Education Division, AT&T Client Education Division, and the Network Training Organization. Describes research into the effectiveness of teletraining technologies in terms of educational integrity, student acceptance, and cost benefits. Concludes that teletraining is an effective means of delivering high quality education to geographically dispersed students.

Clark, G. C. 1988. What goes up must come down: Learning by satellite. *The Computing Teacher* 16(2):13-15.

Provides a brief overview of the use of satellite telecommunications for instruction, and discusses the services of four satellite course providers: TI-IN Network, Arts and Sciences Teleconferencing Service, Satellite Telecommunications Educational Programming Network (STEP), and SciStar Satellite Series.

Clark, G. C. 1989. Distance education in United States schools. *The Computing Teacher* 16(6):11.

Provides an overview of the use of telecommunications and correspondence for instruction in public schools. Methods of distance delivery discussed include correspondence study, telephone audioconferencing, computer-based messaging, interactive television, and satellite broadcast. Raises but does not discuss issues of certification, class size, reception quality, supervision, job security, equal access, funding, and control.

Coldeway, D. O. 1988. Methodological issues in distance education. *The American Journal of Distance Education* 2(3):49.

Reports that the increased precision and sophistication of the research in distance education has been accompanied by an increased interest in research methodology. Discusses values relevant to distance education research, the qualitative/quantitative debate, and the research versus evaluation distinction. Briefly describes and discusses several types of research programs and concludes with the suggestion that more research is needed, particularly in the areas of human learning and motivation and the connection between distance education and the separate but related fields of adult education and instructional technology.

Davis, D. J. 1984. Evaluation and comparison of teleconference training with face-to-face training and the effects on attitude and learning. *Diss. Abstracts International,* Vol. 46, No. AAC850579.

Examines differences in attitude and achievement of adults who

participated in instruction via teleconferencing, in face-to-face instruction, or in a combination of the two methods. Concludes that face-to-face delivery results in more positive attitudes, and reports that as face-to-face contacts increase, so does learner satisfaction with method of delivery. Reports that achievement was comparable in all groups and that there was no significant relationship between attitude and achievement.

Downing, D. E. 1984. *Survey on the Uses of Distance Learning in the U. S.* Austin, TX: Southwest Educational Development Laboratory. ERIC, ED 246 874.

Summarizes a 1983 national survey on the extent to which distance learning techniques are employed in public school instruction, with primary emphasis on interactive forms of distance learning (teleconferencing). Of the twenty-eight states responding, fourteen indicated no current projects or plans for future projects and fourteen reported a wide range of current activities and planned future programs. Presents individual responses to questions regarding resources, financing formulas, numbers of projects, teacher training, subject areas, course development, accreditation, and strategic planning.

Dutton, W., and L. Lievrouw. 1982. Teleconferencing as an educational medium. In *Teleconferencing and Electronic Communications*, eds. L. Parker and C. Olgren, 108-114. Madison, WI: University of Wisconsin-Extension, Center for Interactive Programs.

Examines the role of teleconferencing as an educational medium. Compares the various teleconferencing systems in an educational setting, and presents criteria for the selection of the most appropriate combination of media based on communication tasks, ease of modification, expense, and learning objectives.

Eiserman, W. D., and D. D. Williams. 1987. *Statewide Evaluation Report on Productivity Project Studies Related to Improved Use of Technology to Extend Educational Programs. Sub-Report Two: Distance Education in Elementary and Secondary Schools. A Review of the Literature.* Logan, UT: Wasatch Institute for Research and Evaluation. ERIC, ED 291 350.

Presents a review of the literature on current approaches to distance education at the K-12 level. Describes research results and the implications of this information for future development of distance education. Examines fourteen studies in terms of the types of media used; target populations, content, and instructional design; and judgments of distance education effectiveness. Concludes that additional effectiveness studies are needed and that criteria for both formative and summative evaluations should be established to ensure meaningful data.

Ellertson, E. K., D. Wydra, and H. Jolley. 1987. *Report On Distance Learning. A National Effectiveness Survey.* Mansfield, PA: Mansfield University and the Pennsylvania Teleteaching Project.

Compares the effectiveness and costs of various distance education and traditional instructional methods. Examines factors influencing cost effectiveness (equipment start-up costs, number of students, transmission costs, teacher costs, monitor costs, and special personnel costs) and makes recommendations for enhancing cost effectiveness.

Elliott, G. P. , ed. 1989. Satellite Delivery: What is Going Up for K-12. *Ed: The Distance Education Report.* 3(3):7-18.

Describes credit and non-credit programming available by satellite for K-12 audiences and professional development programs designed for educators and administrators. Programs described include those offered by the Arts and Sciences Teleconferencing Service; the Public Broadcasting Service (PBS); the Satellite Educational Resources Consortium (SERC); SciStar; TI-IN; and Satellite Telecommunications Educational Programming (STEP).

England, R. 1990. The Alabama project. In *Contemporary Issues in American Distance Education*, ed. M. Moore. Oxford: Pergamon Press.

Describes a project designed to fulfill the responsibility of the state of Alabama to more widely provide educational opportunities to a diverse clientele and to consider innovative approaches to meeting citizens' educational needs. Reports on the project's

review of the use of telecommunications for instruction within the state and the resulting policy drafts designed to insure the quality and efficiency of technological delivery of education.

Feasley, C. 1983. *Serving Learners at a Distance: A Guide to Program Practice.* Washington, DC: ASHE ERIC Higher Education Research Report No. 5.

Provides a good introduction to the study of distance education. Discusses distance learner characteristics; faculty attributes and perspectives; specific systems of distance delivery; support services for distance learners; and organizational forms and processes, including planning, management, financing, evaluation, and research.

Florida Postsecondary Planning Commission. 1985. *The Florida Satellite Network Study: Report and Recommendations of the Florida Postsecondary Education Planning Commission Report Two.* Tallahassee, FL.

Provides a comprehensive analysis of satellite networks currently delivering educational programming in Florida.

Galvin, P. 1987. *Telelearning and Audiographics: Four Case Studies.* Norwich, NY: Delaware-Chenango BOCES.

Presents descriptions and analysis of programs included in a Telelearning project (Advanced Placement English, Advanced Placement Calculus, Spanish III, and Electronic Field Trip) developed by the Delaware Chenango BOCES to expand curricular opportunities in rural schools and to address the "provincialism" of rural students. Provides an overview of the findings and recommendations from the formal evaluation of the program.

Gilcher, K. W. and S. M. Johnstone. 1988. *A Critical Review of the Use of Audiographic Conferencing Systems by Selected Education Institutions.* College Park, MD: University of Maryland, College Office of Instructional Communications.

Discusses and analyzes audiographic teleconferencing as an educational delivery medium. Describes the financial benefits of this

medium compared to other distance educational delivery systems and presents faculty and student issues relating to audiographic teleconferencing. Provides an in-depth analysis of the ideal audiographic teaching-learning environment which, the authors contend, depends on various necessary elements, including: the support of top institutional decision-makers; a fully-trained technician; technical training for instructors; instructor compensation for course development time; provision for small group work for off-campus students; convenient student support services; and a mechanism that fosters out-of-class student/student and student/faculty communication.

Haaland, B. A., and W. G. Newby. 1984. Student perception of effective teaching behaviors: An examination of conventional and teleconference based instruction. In *Teleconferencing and Electronic Communications III*, eds. L. Parker and C. Olgren, 211-17. Madison, WI: University of Wisconsin-Extension, Center for Interactive Programs.

Investigates the teaching behaviors necessary for effectively delivering courses both conventionally and via teleconferencing. Concludes that the delivery mode has no effect on students' overall rating of the courses or on ratings of instructors' ability. Five statistically significant differences in effective teaching behaviors were observed more frequently in those teaching via teleconference. Teachers: 1) used students' names, 2) set out clear statements of purpose, 3) made use of printed materials, 4) encouraged discussion, and 5) did not speak in a monotone.

Handler, M. 1988. Meeting an author online. *The Computing Teacher* 16(2):17-19.

Discusses the benefits of computer conferencing for enriching the educational experiences of elementary school students. Describes a computer conferencing experience in which second grade students were able to communicate electronically with the author of a children's book.

Hezekiah, J. A. 1986. Teletechniques: A case study in implementation and evaluation. In *Teleconferencing and Electronic Communications V*, eds. L. Parker and C. Olgren, 332-337. Madison, WI: University of Wisconsin-Extension, Center for Interactive Programs.

Suggests that consideration of four key elements--humanizing, participation, message-style, and feedback--are essential to the success of any teleconferencing experience. Illustrates implementation of these factors in a continuing education program for nurses and provides both instructor and student perspectives on this method of delivery. Includes nine recommendations for enhancing both the effectiveness and acceptance of distance delivery.

Holmberg, B. 1986. *Growth and Structure of Distance Education*. London: Croom Helm.

Discusses the rationale, principles, and practice of distance education. Suggests that modern distance education is not a revolutionary method of instruction, but rather has evolved from earlier forms of distance delivery. Presents and discusses controversial issues and provides an overview of modern practice. Includes sections on development of a theory of distance education and on the concept of distance education as a distinct discipline.

Howard, D. C. 1987. Designing learner feedback in distance education. *The American Journal of Distance Education* 1(3): 24-40.

Suggests that, because the quality of instructor feedback in distance learning situations profoundly affects the experiences of learners, a decision model for the planning of learner feedback is an important dimension of course design, and that such a model should be based on instructional criteria rather than on situational or practical considerations. Presents a model--based on information-processing theories--which allows determination of types of feedback appropriate to specific cognitive tasks. Model includes four aspects of feedback needing consideration: feedback content, degree of individualization, immediacy of feedback, and format.

Hoyt, D. P., and D. Frye. 1972. The effectiveness of telecommunications as an educational delivery system. Manhatten, KS: Kansas State University. ERIC, ED 070 318.

Compares the educational effectiveness of six undergraduate and graduate level courses taught by audioteleconference with

that of identical on-campus classes. Evaluation included instructor assessment of achievement (post-test scores on achievement tests, final exam grades, and final course grades) and student evaluation of the extent to which personal goals were met. Concluded that instruction via audioconferencing was as effective as that delivered traditionally.

Hudson, H. E., and C. H. Boyd. 1984. *Distance Learning: A Review for Educators*. Austin, TX: Southwest Educational Development Laboratory. ERIC, ED 246 872.

Presents major characteristics of a variety of currently operating distance education programs. Discusses issues of cost and management as well as implications of distance delivery.

Independent School High School. 1988. Informational materials. Lincoln, NE: University of Nebraska-Lincoln Independent Study High School.

Provides information about "the only fully accredited University-Based Diploma Program by Independent Study." Answers questions regarding course selection, cost, student supervision, evaluation, and technological options.

Keegan, D. 1986. *The Foundations of Distance Education*. London: Croom Helm.

Provides an in-depth treatment of distance education through discussions of the concept of distance education, theories of distance education, distance education in practice, and evaluation of distance education and specific delivery systems. Presents a theoretical framework which can give "the foundation on which structures of need, purpose, and administration can be erected."

Kentucky Council on Higher Education. 1988. Kentucky Telecommunications Consortium: Action Item CHE (107). Lexington, KY.

Describes the establishment of the Kentucky Telecommunications Consortium to deliver college credit undergraduate and graduate telecourses. Documents the growth in student enrollment from 848 in 1978 to almost 5000 in 1987. Discusses the cost of

telecourses and the problem of funding in the face of faster-than-expected growth. Concludes with recommendations for a gradual assumption of support by institutions served by the Consortium.

Kirman, J. M. , and J. Goldberg. 1980. *One-way television with simultaneous telephone group conferencing using satellite maps as a monitoring device.* A Report to the Innovative Projects Fund. ERIC, ED 224 460.

Reports on a study of the comparative effectiveness of teleconferencing as a means of providing in-service training for teachers. Concludes that a combination of one-way television and two-way audio instruction was at least as effective a means of instruction as face-to-face teaching, and that a majority of teachers rated the method as either an acceptable or a desirable way to receive instruction.

Kitchen, W. 1987. Education and Telecommunications: Partners in Progress. Testimony Before the Senate Committee on Labor and Human Services, March 11. ERIC, ED 282 551.

Examines two major concerns of rural communities: lack of educational opportunities and resources and potentially inadequate telecommunications infrastructures for economic development. Reports that cooperation between rural public schools and local telecommunications providers is allowing some rural areas to achieve educational and economic parity with urban areas by providing educators with alternative delivery systems and by providing a state-of-the-art telecommunications infrastructure for information-based businesses.

Kruh, J. 1983. Student evaluation of instructional teleconferencing. In *Teleconferencing and Electronic Communications II*, eds. L. Parker and C. Olgren, 293-301. Madison, WI: University of Wisconsin-Extension, Center for Interactive Programs.

Reports results of a study of the effectiveness of six university courses taught by teleconferencing compared to that of courses taught in the traditional face-to-face manner. Discusses

the development of a student evaluation form to provide feedback to be used as the basis for recommendations for improvement. Provides sample evaluation forms and describes the treatment of data from student evaluations. Concludes that participant satisfaction in teleconferencing classes is high and that academic achievement in these classes is equal to that of students in resident classes.

Kullen, M. 1984. Evaluating the benefits of teleconferencing as a capital investment. In *Teleconferencing and Electronic Communications III*, eds. L. Parker and C. Olgren, 157-163. Madison, WI: University of Wisconsin-Extension, Center for Interactive Programs.

Discusses equipment, distribution, and production costs of teleconferencing in corporate and public settings. Describes various modes of teleconferencing and their respective benefits. Concludes that, in terms of long-term benefits and considerations, teleconferencing is an efficient and affordable means of disseminating information or providing programming.

Kuramoto, A. 1984. Teleconferencing for nurses: Evaluating its effectiveness. In *Teleconferencing and Electronic Communications III*, ed. L. Parker and C. Olgren, 262-268. Madison, WI: University of Wisconsin-Extension, Center for Interactive Programs.

Describes a project to increase the availability of continuing education to nurses and to develop and evaluate alternative educational delivery methods. Evaluation was conducted on the basis of learners' academic performance and learners' attitudes and behaviors. Analyzed eight variables to assess effectiveness; including cognitive pre- and post-test scores; attitude scores; intent to use and actual use of course content; attendance; and attrition. Concludes that all three delivery methods (face-to-face, teleconferencing, and independent study) were effective in terms of increasing cognitive knowledge; that findings related to attitude were mixed and inconclusive; and that there were no significant differences between learners' stated intent to use course content and the delivery method experienced.

Levinson, C. Y. 1984. *The School Problem-Solver's Guide to Distance Education.* Austin, TX: Southwest Educational Development Laboratory. ERIC, ED 253 380.

Practical guide which provides an overview of distance education use in the southwestern United States in 1984. Discusses who is using distance education, the purposes for which it is being used, the extent of use, and its effectiveness. Provides a list of contact persons and references.

Markowitz, H. 1987. Financial decision making--calculating the costs of distance education. *Distance Education* 8(2):147-161.

Discusses earlier studies comparing the cost of providing higher education at a distance to providing traditional higher education. Provides a framework for determining the "break even" point of a distance education program based on an analysis of fixed and variable costs.

Maryland State Board for Higher Education. 1987. *Telecommunications and Education in Maryland: Report and Recommendations of the Task Force on Instructional Technologies.* Annapolis, MD.

Report of a state task force appointed to advise the Board for Higher Education on coordination of and planning for the use of educational telecommunications technologies and on the appropriate means for assuring the educational effectiveness of instructional television. Documents services currently available as well as current and projected needs, and discusses the relationship between the expansion of educational opportunities and the economic development of different regions of the state. Includes recommendations for meeting the goal of offering "access to instructional television to students of each Maryland college and university and to public and private agencies, institutions, and companies."

Minnesota Higher Education Board. 1986. *Information Technology in Instruction in Minnesota Postsecondary Education Institutions with Coordinating Board Recommendations.* St. Paul, MN.

Suggests that the rapid increases in the use of technology for instruction in post-secondary institutions necessitate addressing issues of funding, faculty development, courseware development, property rights, and interstate program regulation. Concludes that integrated strategic planning is necessary to effectively encourage and support the educational use of telecommunications in the state, and offers seven recommendations for actions which will facilitate reaching this goal.

Monson, M. 1980. *Bridging the Distance: An Instructional Guide to Teleconferencing.* Madison, WI: University of Wisconsin-Extension.

Describes the various implementations of teleconferencing for instructional purposes. Provides techniques for enhancing the success of teleconferencing experiences, discusses the unique benefits of this method of instruction, and provides evidence of educational effectiveness.

Neil, M. 1981. *Education of Adults at a Distance.* London: Kogan Page.

Report based on the Conference on the Education of Adults at a Distance (November 1979). Topics discussed include the growth of distance learning; the concept and implications of distance education; target populations and goals; curricular design; media selection; organization, management and administration of distance learning; collaboration in distance education; international perspectives on distance education; and evaluation of learning at a distance.

Nelson, R. N. 1985. Two-way microwave transmission consolidates, improves education. *NASSP Bulletin* 69(484):38-42.

Discusses the benefits of two-way instructional television to small rural school systems. Stresses versatility, flexibility, and cost as major factors in the choice of educational delivery systems and suggests that instructional television's performance in these three areas makes it an appropriate tool for meeting teacher, students, and community needs.

Norenberg, C. D. and L. Lundblad. 1987. *Distance Delivery of Vocational Education: Technologies and Planning Matrixes.* St. Paul, MN: Minnesota Research and Development Center for Vocational Education.

Suggests that solutions to many current educational problems can result from technological advances which make it possible to provide quality education to learners at a distance. Discusses the general nature of distance education and delivery, describes various distance delivery technologies, and provides information on general, learner, teacher, and pedagogical factors as well as technological costs, advantages, and limitations. Includes separate bibiographical sections relating to background information, technologies, distance delivery systems, pedagogical issues, and research issues and studies.

North Carolina State Department of Human Resources. 1985. *Expanding Human Services Training Through Telecommunications: A Day Care Head Start Study : Executive Summary.* Raleigh, NC: North Carolina State Department of Human Resources. ERIC, ED 259 841.

Study on the feasibility of using teleconferencing as a training medium in comparison to traditional instruction or to audio instruction enhanced with slides, videocassettes, or slowscan. Reports that teleconferencing produces educational results comparable to traditional training and is the most cost effective of the above methods.

Nunley, B. G. 1965. A study of the effectiveness of telelecture in the retraining of elementary teachers in mathematics. Doctoral diss., University of Texas.

Discusses a study to compare the effectiveness of telelecture to face-to-face instruction for the retraining of mathematics teachers. Reports that pre-tests and post-tests of achievement, mathematical ability, and attitudes showed a significantly greater mean change in content mastery for the group receiving instruction by telelecture than for the face-to-face group. Concludes that telelectures are an educationally effective means of instruction.

Oklahoma State Regents for Higher Education. 1988. *Policy and Procedures Pertaining to Off-Campus Programs, Electronic Media and Non-Traditional Methodology.* Oklahoma City, OK.

Statement of criteria and procedures relating to quality control of and inter-institutional coordination of academic courses for off-campus students. Sections include: I. Authorization, Purpose, and Definitions; II. Educational Standards; III. Statewide Coordination of Planning; IV. Fiscal Provisions; V. Reporting; VI. Out-Of-State Courses; and VII. Non-Credit Activities.

Parker, L. and Monson, M. 1980. Teletechniques: An Instructional Model for Interactive Teleconferencing. *The Directional Design Library*, v. 38. New Jersey: Educational Technology Publications.

Based on the experiences of the University of Wisconsin, as well as those of teletraining users in business and government. Discusses teleconferencing as a means of providing education or training to learners at a distance. Topics covered include benefits of teletraining, techniques for teachers/trainers; modes of teletraining (audio, video, audiographics); design factors; "humanizing" techniques; practical considerations; and effectiveness as an educational medium. Also includes design and planning checklists and selected case studies.

Parker, L. 1980. *Teletraining Means Business.* Madison, WI: University of Wisconsin Extension, Center for Interactive Programs.

Discusses the instructional design components of telephone-based education, with emphasis on techniques and materials for humanizing instruction and assuring participation, as well as enhancing message style and feedback.

Partin, G. R., and E. L. Atkins. 1984. Teaching via the electronic blackboard. In *Teleconferencing and Electronic Communications III*, eds. L. Parker and C. Olgren, 68-73. Madison, WI: University of Wisconsin-Extension, Center for Interactive Programs.

Presents an overview of instructional teleconferencing as used

by the U.S. Army Logistics Management Center. Discusses evaluation of this method of instruction through student questionaires and evidence of student achievement. Concludes that students are generally receptive to the teleteach method of instruction; that student achievement is comparable to that resulting from resident instruction; that a knowledgeable facilitator on site enhances the teaching/learning process; and that equipment shortcomings can detract from the learning experiences.

Pereyra, S. 1982. Human factors in establishing an in-house, meet-me system. In *Teleconferencing and Electronic Communications*, eds. L. Parker and C. Olgren, 238-243 Madison, WI: University of Wisconsin Extension, Center for Interactive Programs.

Discusses the importance of "human factors" as opposed to technical factors in assuring the success of teleconferences. Contends that attention to factors such as user training, user resistance, convenience of location or time, and promotion of teleconferencing can heighten user comfort and confidence, thereby enhancing the chances of acceptance and success.

Pinsel, J. K. 1988. *Distance Learning: A Summary of Telecommunications Efforts Involving Education Service Agencies and Others*. Arlington, VA: American Association of Education Service Agencies.

Summarizes national survey information about the involvement of education service agencies in distance learning. Data is organized by geographic region and includes information on implementation of satellite, microwave, and fiber optic systems for the purposes of student instruction and teacher in-service training. Also included are recommendations, a section on telecommunications terminology and definitions, and a listing of the various telecommunications technologies.

Pryor, B. W. 1985. Increasing user acceptance of teleconferencing: A model for understanding and changing user behaviors. In *Teleconferencing and Electronic Communications IV*, eds. L. Parker and C. Olgren, 199-209. Madison, WI: University of Wisconsin, Center for Interactive Programs.

Discusses the problem of user resistance to teleconferencing in terms of resistance to change, and the idea that participant attitudes directly affect behaviors in a teleconferencing situation. Presents a model for understanding and evaluating attitudes and behaviors and a model for changing attitudes and behaviors toward teleconferencing.

Puzzuoli, D. 1970. *A Study of Teaching University Extension Classes by Tele-lecture.* Morgantown, WV: West Virginia University. ERIC, ED 042 961.

Presents an overview of literature on tele-lecture models. Describes a study to determine differences in student achievement and attitudes in college classes taught by traditional instruction and by audioteleconferencing and Electrowriter. Reports that comparative analysis of achievement showed achievement by the remote classes to be equal to or significantly higher than that of resident students and that student attitudes varied depending on the tele-lecture model used.

Quinn, D. W., and D. D. Williams. 1987. *Statewide Evaluation Report on Productivity Project Studies Related to Improved Use of Technology to Extend Educational Programs. Sub-Report Three Survey of Technology Projects Throughout the United States* . Logan, UT: Wasatch Institute for Research and Development. ERIC, ED 291 351.

Reports on a telephone survey of all fifty states to answer the questions: 1) What instructional needs do technology based distance learning projects address? 2) In what subject matter areas? 3) For what levels and types of students? 4) What technologies are used? 5) What evaluation results have been obtained? 6) What are participants' perceptions? 7) How cost-effective are the projects? 8) What other instructional needs are not addressed by the project? Provides a summary of the data for each question, suggestions for further inquiry, and state-by-state summaries of the findings.

Riccobono, J. A. 1986. *Instructional Technology in Higher Education: A National Study of the Educational Uses of Telecommunications Technology in American Colleges and Universities.* Washington, DC: Corporation for Public Broadcasting. ERIC, ED 278 369.

Summarizes the results of a 1985 study on the availability, use, and support of video, audio, and computer instructional technology in colleges and universities in the U.S. Provides information on the extent to which teacher preparation programs include training in these technologies and addresses questions of funding, personnel, and consortium membership and services.

Robinson, R. 1985. An investigation of technical innovation: Interactive T.V. Paper presented at the Annual Convention of the Association for Educational Communications and Technology, Jan. 17-23, Anaheim, CA. ERIC, ED 256 331.

Presents results of a five year evaluation of the two-way Carroll Instructional Television Consortium which serves four school districts in Illinois by providing simultaneous video and audio communication between the sites. Discusses data (obtained by pre/post tests, student/teacher surveys, observation, and interviews) which indicate: 1) student and faculty perceptions of increased system effectiveness and efficiency over time and 2) student achievement levels comparable to those found in live classrooms. Includes data collection instruments.

Rule, S., M. Dewulf, and J. Stowitschek. 1988. An economic analysis of inservice teacher training. *The American Journal of Distance Education* 2(2):12-22.

Contends that in many rural areas appropriate classroom in-service training is unavailable due to time and money considerations. Suggests that alternative means of providing training, such as interactive television, can extend opportunities for staff inservice training, provide individualized training, and assist staff in the implementation of newly learned skills. Compares the actual costs of training delivered via telecommunications and estimated costs of comparable on-site training. Reports that although costs were almost identical during the first year, substantial savings were realized by the use of telecommunications technology in the second and third year of the project.

Rumble, G. and K. Harry (Eds.). 1982. *The Distance Teaching Universities.* London: Croom Helm.

Provides nine case studies of distance teaching universities around the world to assist practitioners and planners in understanding and implementing distance education programs at the university level. Presents an overview and appraisal of distance education and descriptions of programs in Canada, China, Costa Rica, Germany, Israel, Pakistan, Spain, United Kingdom, and Venezuela.

Shaeffer, J. M., and R. G. Roel. 1985. Effective teaching behaviors as perceived by students in a face-to-face and teleconferencing course. In *Teleconferencing and Electronic Communications IV*, eds. L. Parker and C. Olgren, 216-222. Madison, WI: University of Wisconsin-Extension, Center for Interactive Programs.

Reports on a study to empirically determine which teaching behaviors students consider necessary in teleconferencing courses and in face-to-face courses. Also discusses two different methods of obtaining student feedback: group interviews and questionnaires. Results of study indicated that, overall, students in teleconferencing courses gave higher ratings of the course and the intructor's teaching ability than did those in face-to-face classes.

Shale, D. G. 1987. Pacing in distance education: Something for everyone? *The American Journal of Distance Education* 1(2): 21-33.

Defines pacing as "the rate at which a student progresses through a course" and suggests that discussions of pacing have often been unclear because of a confusion of the goals of pacing with the means by which pacing is accomplished. Attempts to clarify the various issues involved in pacing through a discussion of the relationship of pacing to academic standards, activity scheduling, student independence, student interaction, media and methods, and student motivation. Also discusses the costs and effectiveness of pacing. Concludes that serious consideration should be given to questions of why pacing is being considered, what forms of pacing would support program goals, and how to evaluate alternatives.

Showalter, R. G. 1983. *Speaker Telephone Continuing Education For School Personnel Serving Handicapped Children: Final Project Report 1981-82.*. Indianapolis: Indiana State Department of Public Instruction, Indianapolis Division of Special Education. ERIC, ED 231 150.

Summarizes data from a three year project to provide continuing professional education to clinicians and special education personnel via audioteleconferencing. Reports high levels of participant satisfaction and a 55% cost savings over face-to-face instruction. Includes a training manual which discusses 1) soliciting consultants, 2) using the system, 3) pre-planning teleconference instruction, 4) designing instructional strategies, 6) instructing the consultants, and 7) participant evaluation.

Siegmund, D. E. and J. McFadden. 1985. Linking smaller schools for a more effective curriculum. *NASSP Bulletin* 69 (484):35-38.

Describes the formation of an instructional consortium to enable several small schools to share faculty and curricular resources via simultaneous two-way video and audioteleconferencing. Benefits cited include: wider availability of "best" teachers; ability to maintain present curriculum even in the face of declining enrollments; increased opportunity to expand curriculum; elimination of the major costs of transportation as well as time and scheduling conflicts caused by transporting teachers and/or students; development of cooperative spirit among participating districts; provision of a means of communication between teachers in like disciplines.

Smeltzer, L. R. 1986. An analysis of receivers' reactions to electronically mediated communication. *The Journal of Business Communication* 23(4):37-54.

Discusses the effects of electronic communication on the variables of student stimulation, reinforcement, and participation in an educational setting. Reports on a study to determine students' perception of the extent to which the teaching/learning transaction was affected by the teleteaching format. Presents

qualitative and quantitative evidence that audioeleconferencing does not preclude communications-rich interactions between participants. Suggests that the influence of apprehension and nonverbal feedback on student perceptions should be explored further.

Southworth, J. H., and E. B. Klemm. 1985. Increasing global understanding through telecommunications. ***NASSP Bulletin*** **69(480):39-49.**

Describes communication technologies which have been used to facilitate learning links between students in Hawaii and those in other states. Discusses the evolution of an "electronic field trip" program whereby students could expand their learning experiences by participating in multi-site activities and by gaining access to experts in the subject under study. Cites benefits of educational telecommunications including enhanced listening skills, increased access to educational opportunities, and cost effectiveness.

State Council of Higher Education for Virginia. 1987a. ***Regulations Governing the Approval of Certain Institutions to Confer Degrees, Diplomas, and Certificates.*** **VR-380-02-01. Richmond, VA.**

Presents policies and regulations for out-of-state institutions wishing to provide courses in Virginia.

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Presents historical and current perspectives on home study as an alternative to traditional instruction. Cites the widespread recognition and acceptance of this mode of delivery by a variety of organizations and regulatory bodies. Discusses the positive results of effectiveness studies, the unique benefits of home study, and recent advances in correspondence study, including telephonic teaching and testing, televised delivery, videocassette and videodisk lessons, and computer-based training.

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Attempts to analyze the effectiveness of teleconferencing instruction in terms of the prescriptions of child development scholar Arthur Chickering. Describes common intructional practices using new technologies, explains Chickering's theories of quality instruction, and compares teleconferencing to his methods. Concludes that while teleconferencing instruction appears to foster comparable cognitive growth, further research to measure affective, attitudinal, and social growth of students should be performed in teleconferencing classrooms.

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Discusses ways to efficiently choose media on the basis of educational objectives rather than availability of systems. Briefly describes audioconferencing, audio-graphic teleconferencing, videoteleconferencing, and computer teleconferencing and cites advantages and appropriate applications of each medium.

Wall, M. 1985. *Information Technologies: Alternative Delivery Systems for Rural Schools: An Update.* Aurora, CO: Mid Continent Regional Education Laboratory. ERIC, ED 270 253.

Discusses the potential of the use of audioteleconferencing and audiographic teleconferencing for delivery of courses to rural schools. Gives descriptions, expenses, and advantages for various technologies, describes twenty active projects, and discusses implications for rural schools, costs, evaluations, and alterations. Provides advice for choosing, implementing, and enhancing the acceptance of new technologies as well as the names of contact persons involved with the projects described.

Weaver, G. 1982 . The development of a workshop to train faculty to effectively use telcommunications. In *Teleconferencing and Electronic Communications*, eds. L. Parker and C. Olgren, 293-298. Madison, WI: University of Wisconsin-Extension, Center for Interactive Programs.

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Weingand, D. E. 1984. Telecommunications and the traditional classroom: A study of the delivery of education. In *Teleconferencing and Electronic Communications III*, eds. L. Parker and C. Olgren, 269-274. Madison, WI: University of Wisconsin-Extension, Center for Interactive Programs.

Describes a study to determine the validity of the belief that classroom instruction is inherently superior to alternative delivery systems, such as teleconferencing. Analyzed differences in the performance of students in a graduate level library science course taught both by teleconferencing and in the traditional

classroom mode. Concluded that 1) there is no evidence to support the idea that face-to-face instruction is the optimum delivery method, 2) instruction by teleconferencing can facilitate learning equally with or better than classroom instruction, and 3) the absence of face-to-face contact is not detrimental to the learning process.

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The American Journal of Distance Education

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